

EFFECT OF MATERNAL MILK ANTIBODIES ON THE IMMUNOLOGICAL RESPONSE OF THE PROGENY

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The ability of antibodies transmitted with the maternal milk to affect the immunological response of the progeny was studied. Mice were immunized during the last third of pregnancy with sheep's red cells. During the first week of life the young of the immune mothers were suckled by normal mice which had given birth to young at the same time, and vice versa. The results showed that hemagglutinins are transmitted to the progeny with the milk during the period of suckling and cause a decrease in the number of hemolysin-forming cells in the young when immunized with sheep's red cells.

KEY WORDS: immunization; transmission of antibodies by milk to progeny.

Preliminary experiments showed that the immunological response of the progeny of mothers immunized during pregnancy is depressed compared with that of normal mice of the same age. Views regarding the role of antibodies in the inhibition of the immunological response of the progeny have been expressed by a number of workers [1, 3] but the experimental data on this question are incomplete.

The object of this investigation was to study the ability of antibodies transmitted from the immunized mother to the progeny to affect the immunological response of the latter.

EXPERIMENTAL METHOD

In experiments on CBA mice sheep's red cells were used as the antigen. In all the experiments the number of antibody-forming cells (AFCs) was counted by Jerne's direct method on the third day after intravenous injection of 10^9 sheep's red cells. Antibodies were determined by the hemagglutination test (HT).

To study the effect of antibodies on the subsequent response of the progeny, pregnant mice were immunized 5 days before parturition by intravenous injection of 10^9 sheep's red cells. On the first day of life the young of the immunized mothers were suckled by normal mice which had produced young at the same time, and vice versa.

Analysis of the numerical data included calculation of the number of AFCs per 10^6 spleen cells followed by the geometric means and error (expressed in logarithmic units). The mean antibody titers were calculated from binary logarithms of the reciprocals of the titers. Each mean value was calculated from the results of at least six experiments.

EXPERIMENTAL RESULTS

To test the inhibitory action of antibodies transmitted with the milk, it was important to know the duration of their circulation in the serum of the progeny. Progenies of the immunized mice were tested for the presence of background AFCs in the spleen and of agglutinins in the serum at the ages of 30 and 45 days.

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TABLE 1. Discovery of AFCs and Agglutinins in Immunized Mice and Their Progenies ($M \pm m$)

Mothers			Progeny		
time after immunization (in days)	No. of AFCs	titer of agglutinins	age of testing (in days)	No. of AFCs	titer of agglutinins
35	$0,1 \pm 0,2$	$7,1 \pm 0,2$	30	$-0,1 \pm 0,2$	$5,3 \pm 0,0$
50	0	$7,5 \pm 0,4$	45	$-0,2 \pm 0,2$	0

TABLE 2. Discovery of AFCs and Agglutinins in Progenies of Immunized Mice Suckled by Normal Mothers ($M \pm m$)

Normal mothers		Progeny from immunized mice		
No. of AFCs	No. of agglutinins	age (in days)	No. of AFCs	titer of agglutinins
0	0	10	0	0
0	0	20	$-0,1 \pm 0,2$	0

TABLE 3. Discovery of AFCs and Agglutinins in Progenies of Normal Mice Suckled by Immune Mothers ($M \pm m$)

Immune mothers		Progeny from normal mothers		
No. of AFCs	titer of agglutinins	age (in days)	No. of AFCs	titer of agglutinins
$0,4 \pm 0,7$	$10,3 \pm 0,0$	10	0	$9,3 \pm 0,0$
0	$8,3 \pm 0,0$	20	0	$7,8 \pm 0,2$

It will be clear from Table 1 that antibodies were found in high titers in the progeny for 30 days, i.e., throughout the period of suckling. During that same period the number of AFCs in the young mice was no higher than usual.

The hypothesis that antibodies found in suckling mice are transmitted from the mother with the milk is confirmed by experiments whose results are given in Tables 2 and 3. Clearly antibodies in the young aged 10-20 days were found only if they circulated in the sera of the suckling mice. The AFC level in the young mice in this case was normal. It likewise made no difference whether the proper mother of the young mouse was immunized or, in other words, whether the young mouse obtained the antigen through the placenta in the prenatal period.

The results of an experiment showing how antibodies transmitted with the milk affect the immune response of the progeny are given in Table 4. Progenies of immunized mice suckled by nonimmunized mothers gave an immunological response to 10^9 sheep's red cells which was indistinguishable from the response of normal mice. Conversely, the response of normal mice of the same age was reduced by one order of magnitude if they were suckled by immunized mothers. Statistical analysis showed that the differences were significant. It is stated [2] that passively injected immunoglobulins inhibit hemolysin formation in adult rats. Agglutinins against sheep's red cells were found to have the same action in young rats aged 7 days [3]. The number of hemolysin-forming cells in the progeny has also been shown to be inversely dependent on the presence of hemagglutinins in its blood against the corresponding red cells, hypothetically of maternal origin [3]. In the present experiments direct evidence was obtained of an inhibitory role of antibodies, transmitted with the milk, on the immunological response of the progeny. Hemagglutinins against sheep's red cells from the serum of the nursing mothers were shown to be transmitted to the serum of the young mice; this transfer was associated with a decrease in the number of AFCs in the spleen when the young mice were tested for the corresponding antigen at the age of 30 days (the end of the suckling period).

TABLE 4. Immune Response of 30-Day Mice Suckled by Normal or Immune Mothers

Mothers	Progeny	No. of AFCs ($M \pm m$)
Normal	Of immune mothers	$1,5 \pm 0,1$
Immune	Of normal mothers	$0,5 \pm 0,1$
Normal	Of normal mothers	$1,4 \pm 0,3$

It can be concluded from these results that antibodies are transmitted to the progeny with the milk and that they inhibit the formation of hemolysin-forming cells at least during the period of suckling.

LITERATURE CITED

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