Differences in ABO antibody levels among blood donors: a comparison between past and present Japanese, Laotian, and Thai populations

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Passively transfused blood group antibodies cause clinical problems. High titers of anti-A and anti-B seem to be one reason for hemolytic transfusion reactions and for ABO HDN. In Japan, anti-A and anti-B titers notably decreased in the 15 years between 1986 and 2001. At present, titers of more than 100, as measured using the saline method, are rare. Differences in the level of anti-A and anti-B among ethnic populations have been reported; these differences were found to be the result of environmental factors rather than hereditary factors. In the present study, the anti-A and anti-B titers of random donors in three Asian populations are compared. In Thailand, the IgM anti-A and anti-B titers are low and are similar to the Japanese titers reported in 2001, but the IgG anti-A and anti-B titers are high and are similar to the Japanese titers reported in 1986. In the Lao People's Democratic Republic, both the IgM and the IgG anti-A and anti-B titers are high and are similar to those reported in Japan in 1986. In addition, anti-A and anti-B titers of different sex donors and of various age groups were also compared. High titers were found in 8.8 percent of the female donors in the younger than 30 age group and in 36.7 percent of the female donors in the older than 50 age group. ***Immunohematology* 2007;23:38–41.**

Key Words: ABO blood groups, anti-A, anti-B

Passively transfused blood group antibodies cause clinical problems.[1] The effects of anti-A and anti-B in ABO-mismatched platelet transfusions, especially in HLA-matched platelet transfusions, have long been debated. Although reports are rare, intravascular hemolytic transfusion reactions have been known to occur.[2,3] These hemolytic transfusion reactions seem to be caused by high titers of anti-A and anti-B. Such reactions have been seen in groups A, B, and AB recipients receiving group O plasma.

Anti-A and anti-B levels have been reported to differ among ethnic populations.[4] Many previous studies have suggested that ethnicity is a risk factor for ABO HDN. However, the differences among populations were found to be the result of environmental factors rather than hereditary factors.[5,6] Redman et al.[6] addressed the question of variations in ABO antibody levels in persons with different ethnic backgrounds by studying antibody levels in Asian, Caucasian, and African blood donors, all of whom were living in the north London area of the United Kingdom. Although the highest levels of IgG anti-A and anti-B titers were found among group O African female donors, these levels were not significantly higher than those in the other group O donors who were tested.

In this report, we investigated the changes in the anti-A and anti-B titers in the Japanese population during the last 19 years. Both anti-A and anti-B titers decreased greatly during this period. We also compared these titers with the anti-A and anti-B titers in Laotian and Thai populations.

Materials and Methods

Sera were obtained from Japanese blood donors in 1986 (n = 106), 2001 (n = 107), and 2005 (n = 93) in Tokyo, Japan. In 2001, sera were obtained from blood donors in Vientiane, Lao People's Democratic Republic (Lao PDR; n = 58); in 2005, sera were obtained from blood donors in Bangkok, Thailand (n = 93). All serum samples were obtained randomly from the general population of volunteer unremunerated blood donors. The sera were stored at –30°C until tested.

Sera from group O Japanese blood donors classified according to age (16–29 years old and 51–69 years old)

Table 1. Distribution of anti-A and anti-B IgM titers in three populations

Anti-A titer	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**Total (n)**
Laos 2001*	–	–	–	–	–	–	2	**36**	8	6	52
Thailand 2005*	–	6	8	**17**	14	12	11	7	–	–	75
Japan 1986*	–	–	–	–	–	6	3	**67**	7	3	86
Japan 2001*	–	–	–	2	16	**51**	8	1	1	–	79
Japan 2005*	–	9	18	**27**	14	7	–	–	–	–	75
Japan (group O)											
16–29 male	2	9	28	**32**	26	5	–	–	–	–	102
16–29 female	3	14	**32**	31	20	2	–	–	–	–	102
51–69 male	3	24	**32**	23	12	–	–	–	–	–	94
51–69 female	10	9	**13**	9	6	2	–	–	–	–	49
Anti-B titer	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**Total (n)**
Laos 2001*	–	–	–	–	–	–	–	**36**	3	1	40
Thailand 2005*	–	3	5	**17**	11	8	12	6	–	–	62
Japan 1986*	–	–	–	–	–	6	8	**68**	2	4	88
Japan 2001*	–	–	–	11	**69**	9	2	2	–	–	93
Japan 2005*	2	5	17	**27**	7	4	–	–	–	–	62
Japan (group O)											
16–29 male	–	12	**43**	23	19	5	–	–	–	–	102
16–29 female	3	**37**	30	23	7	2	–	–	–	–	102
51–69 male	11	19	**49**	14	1	–	–	–	–	–	94
51–69 female	8	10	**21**	4	5	1	–	–	–	–	49

* Data include group O and nongroup O donors

Table 2. Distribution of anti-A and anti-B IgG titers in three populations

Anti-A titer	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**Total (n)**
Laos 2001*	–	–	–	–	–	13	15	**16**	6	2	52
Thailand 2005*	1	8	8	9	**23**	15	5	3	3	–	75
Japan 1986*	–	–	–	1	3	**39**	21	20	2	–	86
Japan 2001*	–	2	16	**51**	8	1	1	–	–	–	79
Japan 2005*	2	22	**24**	21	6	–	–	–	–	–	75
Japan (group O)											
16–29 male	2	14	**33**	28	14	11	–	–	–	–	102
16–29 female	2	22	23	**34**	9	11	1	–	–	–	102
51–69 male	–	6	18	**35**	32	3	–	–	–	–	94
51–69 female	–	2	**18**	14	4	6	2	3	–	–	49
Anti-B titer	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**	**4096**	**Total (n)**
Laos 2001*	–	–	–	–	–	1	**23**	11	3	2	40
Thailand 2005*	1	1	1	7	12	**19**	15	5	1	–	62
Japan 1986*	–	–	–	–	1	2	28	**32**	22	3	88
Japan 2001*	–	11	**69**	9	2	2	–	–	–	–	93
Japan 2005*	–	17	**20**	16	8	1	–	–	–	–	62
Japan (group O)											
16–29 male	3	28	**37**	27	5	2	–	–	–	–	102
16–29 female	1	26	**39**	17	6	4	4	5	–	–	102
51–69 male	2	15	**40**	29	8	–	–	–	–	–	94
51–69 female	–	4	**15**	4	3	5	10	8	–	–	49

* Data include group O and nongroup O donors

and sex were also collected for the present study. These serum samples were separate from those collected from the general population in 1986, 2001, and 2005.

The sera were titrated using a 1 to 1 dilution with 0.01M PBS, pH 7.2, containing 2% BSA. The IgM antibody titers were determined using the saline method with incubation at room temperature for 15 minutes. The IgG antibody titers were determined by an IAT using LISS and an incubation of 30 minutes at 37°C. Before the IAT, the sera were treated with 2-ME for 15 minutes at 37°C using the method described in the *AABB Technical Manual*[7]; this treatment is used to destroy IgM antibodies in the sera.

Testing was performed by the same person to avoid variations in technique and test interpretation.

Results

In the Japanese population, anti-A and anti-B titers in 1986 were distributed between 64 and 1024 (mode 256) for IgM (Table 1) and between 64 and 2048 (mode 256–512) for IgG (Table 2). In 2001, they markedly decreased to between 16 and 512 (mode 32–64) for both IgM and IgG. In 2005, the IgM titers further decreased to between 2 and 64 (mode 8–16). In the Laotian population in 2001, the IgM titers were similar to those of the 1986 Japanese population; the distribution was between 128 and 1024 (mode 256), whereas the IgG titers were slightly higher than those of the 1986 Japanese

population: between 256 and 4096 (mode 512–1024). In the Thai population in 2005, IgM titers were similar to those of the 2001 Japanese population: the distribution was between 4 and 256 (mode 16), and IgG titers were similar to those of the 1986 Japanese population: the distribution was between 8 and 2048 (mode 128–256).

In the Japanese group O blood donors, IgM titers of anti-A and anti-B were low and no differences were noted between the sexes. However, IgG titers of anti-A and anti-B showed differences between the sexes and an increase with donor age. High titers (> 512) of anti-A, anti-B, or both were found in 8.8 percent (9 in 102) of the female donors in the younger than 30 age group and in 36.7 percent (18 in 49) of the female donors in the older than 50 age group, determined by the antihuman globulin test. No male donors were found with titers more than 256.

Discussion

In the Japanese population, the anti-A and anti-B titers markedly decreased within the 15-year period between 1986 and 2001. At present, the Japanese anti-A and anti-B titers are relatively low, compared with those seen in the Laotian and Thai populations. Schwartz et al.[8] showed that only 3.3 to 3.6 percent of American group O blood donors had high anti-A and anti-B titers (> 100). People with high ABO system antibody titers are now rare among the Japanese population, and the mean titers are lower than those of blood donors in New York.

The mechanisms responsible for the reductions in Japanese anti-A and anti-B titers are unknown. However, previous studies have suggested that environmental factors may influence anti-A and anti-B titers.[5,6] Enteric bacteria and other parasites may affect the production of anti-A and anti-B.[4,6] Environmental factors can affect the prevalence, counts, and susceptibility of enteric bacteria.[9,10] Because environmental factors are thought to affect anti-A and anti-B titers, we compared the anti-A and anti-B titers in three Asian countries: Japan, Lao PDR, and Thailand. Japan has long been a developed country, Lao PDR is a developing country, and Thailand has recently been given developed country status.

The environment in Japan continues to change. Recently, the Japanese lifestyle has become more westernized, especially with regard to food.[11] The prevalence of allergic diseases, heart disease, diabetes, and cancer has been increasing in Japan. In contrast, Lao PDR remains relatively undeveloped, and Laotians usually eat natural foods, whereas Thais and the Japanese eat more processed foods. These environmental differences may explain, at least in part, why the Laotian anti-A and anti-B titers were similar to the titers observed in Japanese donors in 1986, whereas the IgM and IgG antibody titers among the Thais were similar to those observed in the Japanese donors in 2001 and 1986, respectively. Our data support the concept that anti-A and anti-B titers are affected by environmental factors. Lao PDR is rapidly developing and becoming more westernized. We plan to continue our comparison of Laotian and Thai antibody titers in the future.

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