

Poliovirus antibody in Northern Greece

By V. KYRIAZOPOULOU-DALAINA

*Virus Unit, Department of Microbiology, School of Medicine,
Aristotelian University of Thessaloniki, Greece*

(Received 7 November 1984; accepted 9 October 1985)

SUMMARY

In order to study the serological status of the Northern Greek population to poliovirus, 881 sera from healthy people were examined for neutralizing antibody by the micrometabolic inhibition test. The people under examination were aged from 1 day to 70 years old. Overall, of the 881 sera examined, 704 (80%) had antibodies (titre ≥ 4) to poliovirus 1, 742 (84%) had antibodies to poliovirus 2 and 715 (81%) had antibodies to poliovirus 3. Fifty-five per cent of the sera had antibodies to all three polioviruses while 3.3% had no poliovirus antibody at all. There was no statistically significant difference in the rates of seropositivity to the various poliovirus types or between males and females. However the rates of seropositivity did vary with age.

Since 1962, when the Salk vaccine was first introduced into Greece, and 1964 when it was replaced by the Sabin vaccine (Stefanou, 1980), there has not been any documented data on the serological status of the population to polioviruses. The purpose of this study was to establish the frequency of poliovirus antibody in the Northern Greek population, vaccinated against poliomyelitis or not.

The 881 sera examined were collected from healthy people (421 males, 460 females) aged from 1 day to 70 years old. All sera were stored at -20°C , and were inactivated at 56°C for 30 min before testing. The serological method used was a slight modification of the micrometabolic inhibition test for the estimation of poliovirus neutralizing antibodies (Kyriazopoulou & Bell, 1972). Vero cells (kindly supplied by the Department of Virology, St Mary's Hospital, Paddington, London) were used at a concentration of 1×10^5 ml. The test sera were titrated from undiluted to a dilution of 1/512. Antibody titres ≥ 4 were considered as significant. Such titres have been regarded as indicating protection by Doer, Glueck & Esser (1979) and Stramova, Teply & Svadova (1979). Poliovirus strains type 1 Brunhilde, type 2 MEF and type 3 Saukett and the homologous antisera were kindly provided by the State Serum Institute, Copenhagen. The viruses were used at a concentration of 100 TCD₅₀ and titration of the reference sera was included in each batch of tests.

The results of this survey are summarized in Table 1. Overall 704 (80%) of the 881 sera examined possessed antibodies to poliovirus 1, 742 (84%) possessed antibodies to poliovirus 2 and 715 (81%) had antibodies to poliovirus 3. There was

Table 1. *Neutralizing antibodies (titre ≥ 4) against polioviruses 1, 2 and 3 in 881 sera from people of different age groups.*

Age group (days, months, years)	Number examined	Number (percentage) positive for		
		poliovirus 1	poliovirus 2	poliovirus 3
1-90 d	45	27 (60)	32 (71)	28 (62)
4-11 m	40	30 (75)	32 (80)	29 (72)
1-5 y	44	36 (82)	38 (86)	38 (86)
6-10 y	45	39 (87)	40 (84)	40 (89)
11-15 y	57	47 (82)	50 (88)	48 (84)
16-20 y	64	54 (84)	56 (88)	54 (84)
21-30 y	100	64 (64)	74 (74)	68 (68)
31-40 y	116	96 (88)	103 (89)	97(84)
41-50 y	126	105 (83)	110 (87)	106 (84)
51-60 y	124	104 (84)	105 (85)	104 (84)
≥ 61 y	120	102 (85)	102 (85)	103 (86)
Total	881	704 (80)	742 (85)	715 (81)

Table 2. *Full protection from all the polioviruses and lack of antibodies to any of the polioviruses in 881 healthy people of different age groups*

Age group (days, months, years)	Number examined	Number (percentage) positive for	
		All three viruses	None of the viruses
1-90 d	45	5 (11)	5 (11)
4-11 m	40	15 (38)	3 (7, 5)
1-5 y	44	32 (73)	0 (—)
6-10 y	45	33 (73)	0 (—)
11-15 y	57	39 (68)	2 (3, 5)
16-20 y	64	44 (69)	2 (3, 1)
21-30 y	100	42 (42)	7 (7)
31-40 y	116	80 (69)	4 (3, 4)
41-50 y	126	78 (62)	2 (1, 5)
51-60 y	124	64 (52)	2 (1, 6)
61 y	120	52 (43)	2 (1, 7)
Total	881	484 (55)	29 (3, 3)

no difference between the percentage of males and females positive to any of the three polioviruses. The percentage seropositive was lowest in unvaccinated babies under 90 days of age. Higher figures were obtained for the next age group (4-11 months of age) but the difference is not statistically significant ($P > 0.05$).

In the age groups between 1 and 20 years of age the percentage positive is above 80% to all three polioviruses and for each of the 5-year age groups between 1 and 20 years of age the difference between the percentage positive and that of the unvaccinated babies is statistically significant ($P < 0.001$).

In contrast the group 21-30 years of age have a relatively low frequency of antibody and the difference between the percentage in this group and the previous (1-20 years) and following (31-70 years) age groups is statistically significant ($P < 0.001$). Table 2 shows the number with antibody to all three polioviruses and those with no detectable antibody. The variation in percentage with antibody to

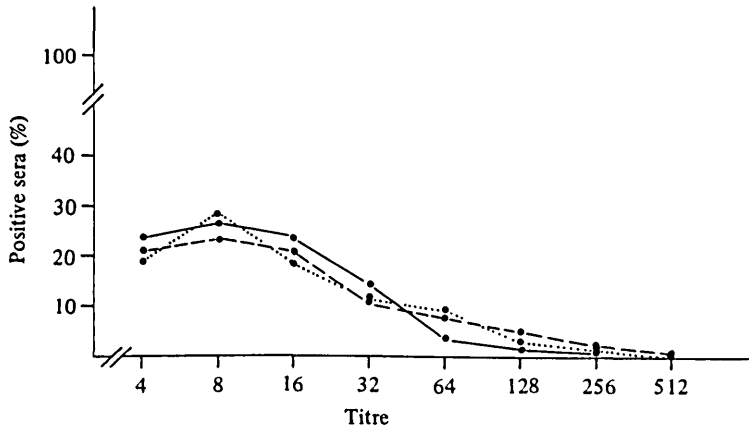


Fig. 1. Distribution of neutralizing antibodies against poliovirus 1 (—), 2 (----) and 3 (.....).

all three viruses shows the same pattern to that of the antibodies to individual viruses.

The percentage distribution by titre of antibodies to each of the three types of polioviruses is shown in Figure 1. Titres between 4 and 32 are the most common while titres ≥ 64 are rare.

Overall the serological status of the population of northern Greece to polioviruses is at a satisfactory high level (80–85%). Relatively low rates are found in babies under 3 months of age but once the administration of Sabin vaccine begins at this age the percentage with antibody rises to above 80%. This frequency is found in all age groups between 1 and 20 years. The significantly lower percentage in the 21–30 year age group is interesting. Individuals in this group would have been 1–10 years old when poliovaccine was introduced into Greece. It is possible that the immunization programme was not entirely satisfactory when it first started. There are no records available but the number of children given vaccine may have been low initially or they may not have been given a full course of immunization. Alternatively it may be that antibodies formed in response to Sabin vaccine may not be detectable after 20 years in some individuals. Further surveys such as the one described here will be necessary in the future to test this.

Our results concerning people over 30 years of age show a very satisfactory immune status. The rate of antibodies in all these age groups are from 83 to 85% for poliovirus 1, from 85 to 89% for poliovirus 2 and from 84 to 86% for poliovirus 3.

These results are contradictory to the results from other countries (Oberhofer, Brown & Monto, 1975) where it was found that the immunity rates fall when the age rises (60% of susceptibles in 60 year-old people).

We believe that differences like this are due to different social and economic conditions. In Greece 20–50 years ago these conditions were poor. People 30 years of age now, who were children at that time, would have been widely exposed to infections with the wild strains of polioviruses. So they have developed high rates of immunity to all the polioviruses that were circulating in the community before vaccine administration. These immunity rates seem to last up to old age.

The general rate (55%) of full protection against all the polioviruses that has been found, seems to be a very adequate one when compared to findings in other countries. Reid *et al.* in 1973 found a rate of 49% for fully-protected people in Scotland, Clara *et al.* in 1976 found 29% full protection in Belgium and Rodriguez *et al.* in 1977, 34% in West Africa.

Children between 1 and 10 years old (Table 2) seem to be very well protected against poliomyelitis (73% full protection) and none lacked antibody to all polioviruses. The overall lack of antibodies to all three polioviruses (3.3%) found in this survey is amongst the lowest recorded when rates are compared with published reports from other countries. In W. Germany 4.7% of the general population lacked antibodies to all polioviruses (Doerr, Glueck & Esser, 1979), in Washington the figure was 1.1% (Burke *et al.* 1979), and in Liberia it was 17% (Rodriguez *et al.* 1977). In the USSR 25% of the children under 3 years of age, 33.8% of the children age 4–7 years and 31.4% of children 8–14 years old lacked poliovirus antibody (Kaplan *et al.* 1974).

Ninety-two per cent of sera examined had antibody titres between 4 and 32. Relatively low titres of antibody were found in young people under 5 years of age compared to those found in the older age groups. No significant difference was found between the overall occurrence of poliovirus antibody or type-specific antibody between males and females.

I am grateful to Professor K. R. Dumbell and the staff of the virus laboratory of St Mary's Hospital, London, for accepting me to work in their laboratory for a month to perform preliminary tests and for providing cell line used in the tests.

REFERENCES

- BURKE, D. S., GAYDOS, J. C., HODDER, R. A. & BANCROFT, W. H. (1979). Seroimmunity in U.S. army recruits. *Journal of Infectious Diseases* **139**, 225–227.
- CLARA, R., DEPTETIERE, A., VAN DEN BERGHE, D. & PATTYN, S. (1979). Poliovirus antibody status after vaccination with trivalent oral vaccine. *Acta Paediatrica Belgica* **24**, 245–251.
- DOER, H. W., GLUECK, H. & ESSER, I. (1979). Immunity against Poliomyelitis in the German Federal Republic. *Deutsche Medizinische Wochenschr* **104**, 1065–1067.
- KAPLAN, A. S., VAILEVSKAYA, N. I., KOZHEVNIKOV, I. N. & STEPANOVA, G. S. (1974). Serologic ascertainment of the status of immunity to poliomyelitis virus in children. *Voprosy Virusologii* **19**, 418–423.
- KYRIAZOPOULOU, V. & BELL, E. J. (1972). A micrometabolic inhibition test for the estimation of poliovirus neutralizing antibodies. *Bulletin of the World Health Organization* **47**, 171–175.
- OBERHOFER, T. R., BROWN, G. C. & MONTO, A. S. (1975). Seroimmunity to poliomyelitis in an American community. *American Journal of Epidemiology* **101**, 333–339.
- REID, D., BELL, E. J., GRIST, N. R. & WILSON, T. S. (1973). Poliomyelitis: a gap in immunity? *Lancet* *ii*, 899–900.
- RODRIGUEZ BURGOS, A., BADA, J. C., FERNANDEZ CALVO, J. L. & DE ARTOLA, V. M. (1977). Seroepidemiology of the poliovirus in Monrovia. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **71**, 118–126.
- STRAMOVA, H., TEPLY, V. & SVADOVA, E. (1970). Persistence of antibodies in a population immunized with oral poliovaccine. *Journal of Hygiene, Epidemiology, Microbiology and Immunology* **23**, 212–219.
- STEFANOU, TH. E. (1980). Preventive Medicine and the Ministry of Social Services. *Hellenic Arm Forces Medical Review*, **14**, 56–69.