Japanese Encephalitis Virus in Pregnant Swine

Principal Investigators: Harry Rozmiarek, MAJ, VC
Dennis O. Johnsen, MAJ, VC
Alson R. Hickerson, SFC
Jerm Pomsdhit

Associate Investigators: Markpol Tingpalapong, DVM
Chumneun Satayaphantha, DVM
Franklin H. Top, Jr., LTC, MC

OBJECTIVE: To establish whether a relationship exists between Japanese encephalitis virus (JEV) infection and economic problems in swine production in Thailand.

BACKGROUND: Although JEV usually causes a clinically inapparent infection in swine, evidence from Japan indicates that it is related to problems of infertility, abortion, and the birth of dead or weak piglets. It has become economically advantageous to suspend the breeding of sows in Japan during the encephalitis season so that the losses resulting from this problem are reduced.

The occurrence of JEV among swine and other domestic animals in Asian areas other than Japan is well documented. In two piggeries located near Udorn and Saraburi, Thailand, significant numbers of weak or dead piglets were born from first litter gilts during the encephalitis season of 1971 in herds where serologic examination later showed JEV infection to be endemic. The productivity of these sows showed great improvement after this first litter. Evidence that JEV is the cause of this problem in Thailand is scanty and only circumstantial; JEV has not been isolated from piglets nor has fetal damage been shown to follow the development of a JEV antibody titer or viremia in the sow. It remains a possibility that the observed problems in swine production are only incidentally related to JEV.

PROCEDURE: The Kasetsart University pig farm located in Saraburi Province was used as the study site. Previous testing has shown antibody titers to JEV in nearly 100% of the adult animals on this farm. Forty three young gilts were selected for this study, which began in April 1972 and was completed in September 1972. All the animals were bred for the first time during April, May, or June. Sera were drawn from each animal every two weeks and antibody titers to JEV measured by the hemagglutination inhibition (HI) method; titers were run in groups every 2 weeks as collected.

Blood was drawn at weekly intervals and inoculated intracerebrally into weanling ICR mice for attemptad virus isolation. The pigs were monitored in this way until they converted (conversion being an eight-fold or greater increase in serum antibody titer) or until after they farrowed. Complete breeding and farrowing records were kept, and the number, health, and appearance of the piglets was recorded.

RESULTS: Only 5 of the 43 animals in the study group still had negative titers at the end of the study; 14 had positive titers when the study began and did not convert, 12 converted before breeding, and 10 converted during gestation. Of the 12 animals showing conversion before breeding, 6 did not conceive after multiple breedings and were sold, and one was bred twice. This can be compared to conception with the first breeding in all 19 animals showing a negative titer and in 12 of 14 animals showing positive titers before the study began. The average litter size in both positive and negative animals was similar, but animals showing JEV titer conversion during gestation suffered from stillbirths and reproductive complications more often than did animals with negative titers. Animals showing negative titers to JEV throughout the study produced an average of 8.60 piglets per litter, those with positive titers produced 7.00, and those converting during the study produced 4.95 healthy piglets per litter. Although a virus was

isolated from many of the laboratory animals inoculated, it was usually identified as Ingwavuma virus and is reported elsewhere. JEV was isolated on one occasion on 7 July 1972, the sow aborted at 32 days gestation on 11 July 1972, and conversion was demonstrated on 14 July 1972.

DISCUSSION: As previously stated, JEV was identified on only one of the isolation attempts. As 22 animals showed JEV titer conversions during the study, it is assumed that these animals were viremic earlier, but that they were no longer viremic on the day samples were taken for attempted virus isolation.

Table 1 indicates that although the average litter size of all groups in the study was similar, sows showing JEV titer conversion during the study had a significantly lower number of healthy piglets than sows not showing conversion. This is true both for animals infected before and during gestation. In the animals which converted before breeding, this is the result of a markedly decreased conception rate. The animals infected during gestation showed a high conception rate, but experienced more complications during gestation and parturition than either animals infected before conception or animals not converting. In both cases, the result was a significant decrease in the number of healthy offspring produced by animals infected with JEV. Animals already showing high antibody titers at the start of the study were similar to those with negative titers throughout the study in that conception rate was high, few reproductive problems were experienced, and a relatively high number of healthy piglets per sow were produced.

CONCLUSION: Natural infection with the virus of Japanese encephalitis has been shown to reduce the reproductive efficiency of susceptible sows. Serologic and virus isolation studies indicate transmission of JEV in the herd during the study period. Infection immediately prior to breeding appears to reduce the rate of conception, while infection during pregnancy appears to induce a high frequency of complications during gestation and at parturition, particularly a high incidence of stillbirths. The reproductive efficiency was comparatively higher both in sows with high antibody titers not showing evidence of infection near the time of gestation and in sows with negative JEV antibody titers.

Table 1. Production record of gilts

Time of JEV Conversion(a)	No. of Animals	Concep -- tion Rate	Ave. Litter Size	Healthy Piglets Per Sow	Remarks
2 mo. before breeding	10	40 %	9.1	3.90	3 — had normal litters 1 — dystocia — 5 piglets suffocated 1 — bred 2 times — 3 stillborn 5 — did not conceive in 3 successive breedings
1 mo. before breeding	2	50 %	9.0	4.00	1 — stillborn 1 — did not conceive in 3 successive breedings
2nd month of gestation	6	100 %	8.8	6.33	4 — had normal litters 1 — 4 stillborn, 2 died the first week 1 — aborted 32 days gestation (e)
3rd month of gestation	4	100 %	8.5	6.00	3 — had normal litters 1 — 2 stillborn; sow developed metritis and all piglets died in 1 week
Negative titer (b)	7	100 %	9.6	8.60	4 — had normal litters 1 — 5 stillborn 2 — conceived, sow sold for unrelated reasons (d)
Positive titer (c)	14	88 %	8.4	7.00	10 — had normal litters 2 — one non — fertile breeding — sold 2 — sow died of unrelated problems (d)

(a) Conversion is an eight fold or greater increase in titer.

(b) Negative titer is 1:20 or less.

(c) Positive titer is 1:80 or greater

(d) These animals were not used in calculating the healthy piglets per sow

(e) JEV was isolated from this sow.