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Sensitization procedures and the blood sugar concentration

It is relatively easy to induce anaphylactic shock in guinea-pigs but rats and mice are generally resistant to its development. The injection of *Bordetella pertussis* vaccine at the time of sensitization however increases the susceptibility of rats and mice (Dhar & Sanyal, 1963). Hypoglycaemia results when rats and mice are injected with *B. pertussis* vaccine (Dhar, Sanyal & West, 1967a) but it is not known whether such treatment alters the blood sugar concentration in guinea-pig, rabbits and dogs. Experiments have therefore been made to investigate the effects of *B. pertussis* vaccine, or antigen, or of both adjuvant and antigen, on the blood sugar concentrations of these animal species, and so to determine whether hypoglycaemia aggravates the symptoms of anaphylactic shock.

Groups of 8 adult animals were sensitized by an intraperitoneal injection of horse serum (1 ml in mice, rats and guinea-pigs, 2 ml in rabbits, and 5 ml in dogs) with or without *B. pertussis* vaccine (80×10^6 organisms per ml—0.5 ml in rats, mice and guinea-pigs, 1 ml in rabbits, and 2.5 ml in dogs). Other groups of animals were injected with only the vaccine. Every 4 days after the injection of antigen or vaccine, samples of blood from the tail vein of rats and mice, the ear vein of guinea-pigs and rabbits, and the femoral vein of dogs were removed for sugar assay using the Folin-Wu method.

The results in Table 1 show that *B. pertussis* vaccine alone induced a hypoglycaemia of 25-35% which commenced about 8 days after treatment, reached a peak at about 12 days, and ended by about day 24. The pattern of events in each of the species was similar. When the antigen was given alone, a significant hypoglycaemia was found in rats, mice and guinea-pigs but not in rabbits and dogs. Whereas the blood sugar

Table 1. *Effect of B. pertussis vaccine (BPV) and horse serum on the blood sugar concentrations of animals at different times after treatment.* Mean values (mg/100 ml) from groups of 8 animals are recorded.

Species	Treatment	Day after treatment						
		0	4	8	12	16	20	24
Rat	BPV	102	88	78*	76*	78*	90	100
	Horse serum	104	108	108	92	88*	94	102
Mouse	BPV	98	90	82	78*	78*	86	98
	Horse serum	92	94	96	80	76*	78*	94
Guinea-pig	BPV	110	98	80*	82*	74*	92	100
	Horse serum	115	112	110	115	110	92	74*
Rabbit	BPV	115	88	80*	86*	88	98	100
	Horse serum	112	122	120	124	128	120	100
Dog	BPV	120	110	90	84*	92	108	102
	Horse serum	124	118	120	130	124	110	100

* Significantly different from control values ($P < 0.05$).

concentrations returned to control values in rats and mice by 24 days after treatment with antigen, the return in guinea-pigs was delayed.

When the antigen was given with the adjuvant, marked hypoglycaemia was found in rats and mice by day 12 and in guinea-pigs, rabbits and dogs by day 24. When challenged with intravenous antigen at these times after sensitization, all groups had higher mortality rates than those of animals sensitized with antigen alone (Table 2). Deaths occurred within 2 h of challenge, animals exhibiting symptoms of anaphylactic shock typical of the reaction of the species. Without adjuvant, animals showed mild shock and mortalities were obtained in rats (20%), mice (50%), and guinea-pigs (100%). The conditions of sensitization of the Indian rabbits and dogs used were not optimal for maximum anaphylactic shock, and now different strains of animals are under investigation.

Table 2. *Effect of B. pertussis vaccine (BPV) on the mortality of animals undergoing anaphylactic shock. Mean blood sugar values (mg/100 ml \pm s.e.) before challenge are also shown. Rats and mice were challenged on day 12, guinea-pigs, rabbits and dogs on day 24.*

Species	Sensitization	Mortality rate (%)	Blood sugar
Rat	Horse serum	20	92 \pm 12
	Horse serum + BPV	100	68 \pm 7
Mouse	Horse serum	50	80 \pm 5
	Horse serum + BPV	100	68 \pm 10
Guinea-pig	Horse serum	100	74 \pm 6
	Horse serum + BPV	100	70 \pm 4
Rabbit	Horse serum	0	100 \pm 12
	Horse serum + BPV	50	80 \pm 8
Dog	Horse serum	0	100 \pm 8
	Horse serum + BPV	38	82 \pm 7

The present results show that a lowered blood sugar concentration contributes to the severity of *systemic* anaphylactic shock in all the five species tested. Nevertheless, it must not be overlooked that the intensity of the *local* cutaneous anaphylactic reaction is not always modified by hypoglycaemia or hyperglycaemia (Dhar, Sanyal & West, 1967b).

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