BODY TEMPERATURE AND RESPONSE TO PYROGENAL IN GERMFREE AND ORDINARY ANIMALS

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The body temperature and response to pyrogenal were studied in germfree and ordinary mice and miniature piglets. The body temperature of intact germfree mice and miniature piglets was found to be below that of ordinary animals of the same species. After intraperitoneal injection of pyrogenal (10 minimal pyrogenic doses) into mice and intramuscular injection of pyrogenal into piglets (500 minimal pyrogenic doses) the absence of a marked febrile reaction was observed in the germfree animals. The results point to the important role of the autoflora in the development of the ability of the animal to produce a temperature reaction and fever.

KEY WORDS: germfree animals; body temperature; fever; pyrogenal.

Great importance is attached to the febrile reaction in the mechanisms of nonspecific resistance to infection [1]. However, the role of the microbial factor of the autoflora of the organism in the development of ability to give a febrile reaction has been inadequately studied. For this purpose a comparative study was made of the body temperature and febrile reaction to pyrogenal in germfree and ordinary animals.

EXPERIMENTAL METHOD

In the experiments to study the body temperature and febrile reaction to pyrogenal, germfree C3H/He mice obtained from the French Center for Selection and Breeding of Germfree Animals (IFFA-CREDO) were used. The body temperature also was measured in germfree miniature piglets obtained and reared by the methods developed in the writer's laboratory [2]. Ordinary animals of the same species served as the control. All the animals were aged 1.5 months. The germfree animals were kept in sterile gnotobiological isolators, they received a sterile diet, and they were subjected to careful microbiological control to ensure that they conformed to the general standards of gnotobiological technology [4]. The germfree and ordinary animals were kept in rooms with the same air temperature (20°C).

The rectal temperature of the intact animals was measured at the same time of day by means of the TPEM-1 electrothermometer. The temperature of the germfree animals was measured actually in the isolator by means of a device allowing wires to be taken through a stopper in the lock of the isolator without disturbing its airtightness. The surface of the polyvinyl chloride tube into which the wires were soldered was sterilized in the lock of the isolator with peracetic acid, and the tips of the detectors were sterilized in an airtight polyvinyl chloride hood by means of 10% tincture of iodine. The temperature of the intact animals was measured over a period of 1 week and the mean values were calculated.

To study the febrile reaction to the pyrogen a standard solution of pyrogenal, supplied by the N. F. Gamaleya Institute of Microbiology and Epidemiology, was used. The preparation was injected intraperitoneally (10 minimal pyrogenic doses) into the mice and intramuscularly (500 minimal pyrogenic doses) into the piglets. From 8 to 10 germfree and ordinary animals of each species were used in the experiments. The temperature reaction was studied over a period of 4 h after injection of the pyrogenal.

EXPERIMENTAL RESULTS

Measurement of the rectal temperature of the intact germfree and ordinary mice, kept under identical ambient temperature conditions (20°C) showed that the body temperature of the germfree mice was lower than that of the ordinary mice ($P < 0.001$; Fig. 1a). The same tendency also was observed in the germfree piglets,

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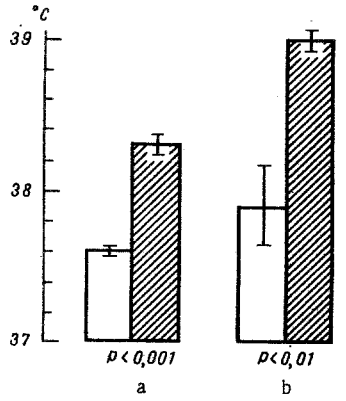

Fig. 1. Rectal temperature of germfree and ordinary mice before and after injection of pyrogenal: a) intact animals; b) animals after injection of pyrogenal. Unshaded columns show germfree mice, shaded columns ordinary mice.

whose mean body temperature was 38.5 ± 0.1°C, whereas that of the ordinary piglets was higher, namely 39.1 ± 0.3°C.

In response to injection of pyrogenal a marked rise of temperature was observed in the ordinary mice, whereas no significant rise of temperature was found in the germfree mice (Fig. 1b). After injection of pyrogenal into the ordinary piglets the body temperature rose by 1°C 1 h after the injection (the mean temperature was 40.1 ± 0.11°C), and 4 h later the temperature had fallen to normal. Under the same conditions no significant increase in body temperature of the germfree piglets was observed.

The lowered body temperature of the germfree animals evidently reflects their characteristic depression (by 20-25%) of metabolism [5]. The absence of a marked temperature reaction of the germfree animals correlates with the lowered values of other indices of specific resistance and, in particular, of phagocytosis under gnotobiological conditions [3]. The results point to the important role of the autoflora in the development of the temperature reaction of the host animal and in the mechanisms of fever, possibly on account of stimulation of the liberation of endogenous pyrogenic factors.

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