Prostaglandin F2a Induced Nest Building Behavior in the Non-Pregnant Sow, and Some Welfare Considerations

Judith K. Blackshaw

University of Queensland

Follow this and additional works at: http://animalstudiesrepository.org/acwp_faafp

Part of the Animal Studies Commons, Other Animal Sciences Commons, and the Veterinary Toxicology and Pharmacology Commons

Recommended Citation

This Article is brought to you for free and open access by the Humane Society Institute for Science and Policy. It has been accepted for inclusion by an authorized administrator of the Animal Studies Repository. For more information, please contact eyahner@humanesociety.org.
feature of every design. Menzel (1971) eloquently championed this cause when he wrote:

"Almost any novel, moving, changing or intense stimulus is apt to enhance physiological arousal level and overt responsiveness for a time; but then — assuming the stimulus is innocuous — its effect steadily diminishes with repeated presentations, as if each stimulus in turn must lose its charge and become assimilated into the indifferent standard."

Some infertility in humankind appears to derive from the influence of "psychological" variables. Our understanding of such events is poor. It is not altogether unlikely that similar factors may be at least partially to blame for the reproductive problems of our closest living relatives, the great apes. As physical and social opportunities are enhanced, captive great ape reproduction should be similarly affected.

In quoting his mythical character, the chimpanzee "Pano," William Conway (1978) recently remarked that "a laboratory might be a nice place to visit, but I wouldn't want to breed there." This accurately portrays one of our most difficult problems. Although laboratories are inherently more restrictive in character than zoological gardens, it is possible to soften and render the most difficult of environments. Constraints of time and money, if not human inertia, are the typical obstacles to such progress. It is useful at this point to apply the definition of health which has been suggested by the World Health Organization. As stated in their constitution: "Health is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity." By the scope of this definition, healthy apes are those that are active, sociable, busy, and reproductively successful. Environmental Psychology is a tool for achieving these ends.

There is much work to do as we extend the boundaries of Environmental Psychology into the domain of animal behavior. The great apes represent a unique test case, and it is with them that the potential applications may be most usefully applied.

References

Prostaglandin F2α
Induced Nest Building Behavior in the Non-Pregnant Sow, and Some Welfare Considerations

Judith K. Blackshaw

Dr. Blackshaw is with the Department of Animal Production, University of Queensland, St. Lucia, Brisbane, Australia.

Nest building behavior, induced with intramuscular injections of prostaglandin F2α (PGF2α), was studied in non-pregnant sows. Acute effects, which included salivation, scratching, vomiting, defaecation and ataxia, were also recorded. Sows (Large White × Landrace) were housed in two different environments: six sows in bare pens and six sows in pens provided with bedding material. In all cases except one (bare pen) nest building sequences to around the farrowing nest (Kurz and Marchinton, 1972), were recorded. Sows (Large White × Landrace) were housed in two different environments: six sows in bare pens and six sows in pens provided with bedding material. In all cases except one (bare pen) nest building sequences to around the farrowing nest (Kurz and Marchinton, 1972). These nests are shallow pits made by sows and are lined with bedding material (Hanson and Kast, 1959; Kurz and Marchinton, 1972), to provide shelter for the sow and her newborn pigs. The nests of the Australian feral pig reported by Pullar (1950) were
large (6–8 ft in diameter) and well camouflaged, consisting of interlaced branches, fern fronds and grass.

Domestic pigs will attempt to build a nest with whatever material is available but concrete floors and farrowing crates prevent much of the nest building behavior, although many of the motor elements are still present (Signoret, Baldwin, Fraser and Hafez, 1975).

Nest Building Behavior

Several phases of nest building can be distinguished in the wild pig after she has selected a suitable place (Frädrich, 1974). With her snout she digs a hollow about the same length as her body. She then collects dry grass, leaves and small sticks to line the nest. This material is evenly distributed over the hollow by rooting and moving in a circle. Leaves and grass lying outside the nest are brought in by pawing with the front legs. These actions may be repeated several times so that the completed nest is of several layers and may become one meter high. As the sow uses the heap it becomes flatter and assumes a round or oval form.

In domestic pigs, Jones (1966), described efforts to begin preparing a nest during the 24 hours before parturition. During the 6 hours before parturition nest building activity increased and the sows made vigorous pawing movements of each foreleg working alternately. This appeared to distribute the bedding to the animal’s liking. Often the sows would move the bedding from one position to another. Periods of nest building alternated with quiet intervals until 60 to 15 minutes before the birth of the first pig, when the sows lay quietly on their sides.

The use of prostaglandin (PG) F2α for induction of farrowing in the sow is used in intensive piggery management (Diehl and Day, 1974), and it is known that PGF2α causes an immediate increase in prolactin levels in the sow (Taverne et al., 1978/79). Maternal behavior patterns (such as nest building and retrieval of young) in young virgin rams have been induced by the administration of prolactin (Riddle et al., 1935).

Preliminary work showed that PGF2α injections induced nest building behavior in non-pregnant sows (Blackshaw and Smith, 1982). Boars also responded to PGF2α by displaying elements of copulatory behavior but with no signs of nesting behavior (Blackshaw, J. and Blackshaw, A., 1982).

The present study was undertaken to study in detail the acute behavioral effects of PGF2α on the non-pregnant sow and the resulting nest building behavior. Welfare implications were also considered for the housing of sows in a bare environment or in an area supplied with bedding material.

Materials and Methods

The non-pregnant sows (Large White x Landrace) were in two groups. One group of sows (6) were housed in the intensive, 55 sow, Specific Pathogen Free piggery at the Veterinary Science Farm, University of Queensland, Australia, in bare pens (2.0 m x 1.5 m). The other group of sows (6) was penned (3.5 m x 1.4 m) at the University’s Large Animal Clinic, and supplied with straw or shredded paper. All floor surfaces were concrete.

Each sow was injected intramuscularly with PGF2α (Lutalyse, Upjohn) using 10 mg/100 kg, on four occasions following a control injection (buffer and solvent) one hour before. Injections were made during lactation (1–2 days before weaning) or the second post-weaning oestrus, the subsequent luteal phase (11–13 days post oestrus) and the second oestrus (21 days). Observations were recorded for 45 minutes after both control and test injections. Acute effects and nest building activity were recorded in detail.

Results

Prostaglandin F2α caused behavioral changes in both groups of non-pregnant sows, which were not observed after control injections. The acute effects included salivation, chewing movements, scratch­ing with a hind leg, rubbing on the wire pen side, vomiting, defaecation and ataxia. Nest building behavior included snout rubbing on the floor, straw or paper gathering if available, pawing and walking in circles. The acute and nest building behaviors are defined in Table 1.

The onset of the acute behaviors after PGF2α injection was between 1–15 minutes. Table 2 shows the frequency of acute behaviors in both groups of sows and the time of onset after injection. All sows in both groups salivated and made chewing movements; they also scratched with their back legs, rubbed against the pen wire, defaecated and displayed ataxia. Vomiting was restricted to 2 pigs in the piggery and 5 in the clinic.

Nest building behavior was induced in all 6 sows provided with bedding material, and in 5 sows in the piggery. This behavior began 19–38 minutes after injection.

A complete nest building sequence of a sow in a bare environment included:

a) walking around the pen,
b) vigorously snout rubbing on the floor in a confined area,
c) pawing with front legs in that area,
d) circling again and snout rubbing,
e) lying down on one side in that area.

<table>
<thead>
<tr>
<th>TABLE 1 Definitions of Acute and Nest Building Behaviors After Prostaglandin F2α Injection into Non-pregnant Sows.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior</td>
</tr>
<tr>
<td>Acute Salivation</td>
</tr>
<tr>
<td>Chewing movement</td>
</tr>
<tr>
<td>Scratch</td>
</tr>
<tr>
<td>Rub</td>
</tr>
<tr>
<td>Ataxia</td>
</tr>
<tr>
<td>Nest Building</td>
</tr>
<tr>
<td>Straw or paper collecting</td>
</tr>
<tr>
<td>Pawing</td>
</tr>
<tr>
<td>Circling</td>
</tr>
<tr>
<td>Nest building</td>
</tr>
</tbody>
</table>
large (6–8 ft in diameter) and well camouflaged, consisting of interlaced branches, fern fronds and grass.

Domestic pigs will attempt to build a nest with whatever material is available but concretes floors and farrowing crates prevent much of the nest building behavior, although many of the motor elements are still present (Signoret, Baldwin, Fraser and Hafez, 1975).

**Nest Building Behavior**

Several phases of nest building can be distinguished in the wild pig after she has selected a suitable place (Frädrich, 1974). With her snout she digs a hollow about the same length as her body. She then collects dry grass, leaves and small sticks to line the nest. This material is evenly distributed over the hollow by root- ing and moving in a circle. Leaves and grass lying outside the nest are brought in by pawing with the front legs. These actions may be repeated several times so that the completed nest is of several layers and may become one meter high. As the sow uses the heap it becomes flatter and assumes a round or oval form.

In domestic pigs, Jones (1966), described efforts to begin preparing a nest during the 24 hours before parturition. During the 6 hours before parturition nest building activity increased and the sows made vigorous pawing movements of each foreleg working alternately. This appeared to distribute the bedding to the animal’s liking. Often the sows would move the bedding from one position to another. Periods of nest building alternated with quiet intervals until 60 to 15 minutes before the birth of the first pig, when the sows lay quietly on their sides.

The use of progestin (PG) F2a for induction of farrowing in the sow is used in intensive pig rearing management (Diehl and Day, 1974), and it is known that PGF2α causes an immediate increase in prolactin levels in the sow (Taverne et al., 1978/79). Maternal behavior patterns (such as nest building and retrieval of young) in young virgin rats have been induced by the administration of prolactin (Riddle et al., 1935).

Preliminary work showed that PGF2α injections induced nest building behavior in non-pregnant sows (Blackshaw and Smith, 1982). Boars also responded to PGF2α by displaying elements of copulatory behavior but with no signs of nesting behavior (Blackshaw, J. and Blackshaw, A., 1982).

The present study was undertaken to study in detail the acute behavioral effects of PGF2α on the non-pregnant sow and the resulting nest building behavior. Welfare implications were also considered for the housing of sows in a bare environment or in an area supplied with bedding material.

**Materials and Methods**

The non-pregnant sows (Large White x Landrace) were in two groups. One group of sows (6) were housed in the intensive, 55 sow, Specific Pathogen Free piggery at the Veterinary Science Farm, University of Queensland, Australia, in bare pens (2.0 m x 1.5 m). The other group of sows (6) was penned (3.5 m x 1.4 m) at the University’s Large Animal Clinic, and supplied with straw or shredded paper. All floor surfaces were concrete.

Each sow was injected intramuscularly with PGF2α (Lutalyse, Upjohn) using 10 mg/100 kg, on four occasions following a control injection (buffer and solvent) one hour before. Injections were made during lactation (1–2 days before weaning) the post-weaning oestrus, the subsequent luteal phase (11–13 days post oestrus) and the second oestrus (21 days). Observations were recorded for 45 minutes after both control and test injections. Acute effects and nest building activity were recorded in detail.

**Results**

Prostaglandin F2α caused behavioral changes in both groups of non-pregnant sows, which were not observed after control injections. The acute effects included salivation, chewing movements, scratching with a hind leg, rubbing on the wire pen side, vomiting, defaecation and ataxia.

Nest building behavior included snout rubbing on the floor, straw or paper gathering if available, pawing and walking in circles. The acute and nest building behaviors are defined in Table 1.

The onset of the acute behaviors after PGF2α injection was between 1–15 minutes. Table 2 shows the frequency of acute behaviors in both groups of sows and also the time of onset after injection.

All sows in both groups gathered and made chewing movements; they also scratched with their back legs, rubbed against the pen wire, defaecated and displayed ataxia. Vomiting was restricted to 2 pigs in the piggery and 5 in the clinic.

Nest building behavior was induced in all 6 sows provided with bedding material, and in 5 sows in the piggery. This behavior began 19–38 minutes after injection.

A complete nest building sequence of a sow in a bare environment included:

- a) walking around the pen,
- b) vigorously snout rubbing on the floor in a confined area,
- c) pawing with front legs in that area,
- d) circling again and snout rubbing,
- e) lying down on one side in that area.

**Table 1:** Definitions of Acute and Nest Building Behaviors After Prostaglandin F2α Injection to Non-pregnant Sows.

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td></td>
</tr>
<tr>
<td>Salivation</td>
<td>Saliva drips from mouth.</td>
</tr>
<tr>
<td>Chewing movement</td>
<td>Pig opens and shuts mouth 2–4 times. May or may not be accompanied by salivation.</td>
</tr>
<tr>
<td>Scratch</td>
<td>Pig uses either back leg to reach its side and/or belly area.</td>
</tr>
<tr>
<td>Rub</td>
<td>Pig stands beside wire of pen and rubs side, face or rump area up and down.</td>
</tr>
<tr>
<td>Ataxia</td>
<td>Pig becomes very unsteady in the back legs.</td>
</tr>
<tr>
<td>Nest Building</td>
<td></td>
</tr>
<tr>
<td>Snout rubbing</td>
<td>The top of the snout is rubbed against the floor as though pushing straw into a pile. If straw is provided the snout is used to make a pile. It is distinct from floor feeding where the bottom lip is extended and used to gather food from the floor.</td>
</tr>
<tr>
<td>Straw or paper collecting</td>
<td>Pig may collect bedding in its mouth and carry it to a desired place.</td>
</tr>
<tr>
<td>Pawing</td>
<td>The front legs are used alternately in a rapid up and down movement along the floor in front of the pig (2 to many times &gt; 10).</td>
</tr>
<tr>
<td>Circling</td>
<td>The pig walks in a circle in the nest area which may be bare or contain a straw or paper nest.</td>
</tr>
<tr>
<td>Nest building</td>
<td>The complete activity includes snout rubbing, pawing, straw collecting, circling. Some pigs may not show all these elements.</td>
</tr>
</tbody>
</table>
TABLE 2 Acute Behavioral Responses of Sows After PGF2α [10 mg/100 kg] Injection. Each of the Sows in the Two Groups Was Tested on 4 Occasions over 21 Days.

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Clinic environment</th>
<th>Pig environment</th>
<th>Onset after PGF2α (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salivation</td>
<td>24 (6)*</td>
<td>24 (6)</td>
<td>1 – 8</td>
</tr>
<tr>
<td>Chewing movement</td>
<td>24 (6)</td>
<td>24 (6)</td>
<td>1 – 8</td>
</tr>
<tr>
<td>Scratching</td>
<td>24 (6)</td>
<td>24 (6)</td>
<td>3 – 9</td>
</tr>
<tr>
<td>Rubbing</td>
<td>24 (6)</td>
<td>24 (6)</td>
<td>3 – 5</td>
</tr>
<tr>
<td>Vomiting</td>
<td>20 (5)</td>
<td>8 (2)</td>
<td>4 – 6</td>
</tr>
<tr>
<td>Defaecation</td>
<td>24 (6)</td>
<td>24 (6)</td>
<td>2 – 14</td>
</tr>
<tr>
<td>Ataxia</td>
<td>24 (6)</td>
<td>24 (6)</td>
<td>2 – 7</td>
</tr>
</tbody>
</table>

*Number of pigs showing behavior

These activities were performed for 1-10 minutes, but not all pigs showed all nest building behaviors after each injection. Snout rubbing and pawing occurred in 70 percent of the observations and imitate the nest building phases described by Fradrich (1974).

Pigs in the environment provided with bedding material showed similar behavior except they collected the material in their mouths or pushed it together with their snouts, to make a nest. One pig consistently made a very large nest 0.5 m x 1.5 m and 15-20 cm high. Another pig although supplied with nesting material with which it played, made an "imaginary" nest like the pigs in the bare environment.

Another feature of the nest building behavior was its intensity (Table 3). This is a subjective measurement which was recorded during observation. Very active snout rubbing and pawing was scored as intense (3); less active, as medium (2); and in cases where the behavior was performed once, this was recorded as weak (1).

From Table 3 it is seen that 3 of the 5 sows showing nest building activities in the bare environment and 5 of the 6 sows in the environment with bedding, showed intense behavior during lactation (post weaning). Two of the 5 nest building sows in the bare environment showed intense behavior during the second oestrus, and 4 of the 6 sows provided with bedding showed similar behavior. Table 3 also indicates the individual differences in nest building behavior of non-pregnant sows.

Discussion

This study shows nest building activity can be induced by PGF2α injection in non-pregnant sows housed in bare pens or supplied with bedding material. In both environments nest building behavior was similar, and followed the pattern of behavior seen in wild pigs (Fradrich, 1974) and in domestic pigs preparing a nest during the 24 hours before parturition (Jones, 1966).

There is a growing awareness of animal welfare as it affects pig production. Emphasis is placed on the provision of an environment which will satisfy the behavioral needs of intensively housed pigs. Farrowing crates without bedding may seem unsuitable for sows but this study suggests that sows will carry out nest building sequences even without bedding material. It is interesting that one sow in the pen provided with bedding material did not use the material but built an "imaginary" nest, while performing the nest building sequences. The main requirement which can be suggested for sows just before parturition is that they have enough space to perform the various nest building behaviors.

During lactation, prolactin plays an important role, and levels of plasma prolactin are elevated at the beginning of an oestrous cycle and towards the end (Hughes and Varley, 1980). The added prolactin release caused by PGF2α adminis-
These activities were performed for 1–10 minutes, but not all pigs showed all nest building behaviors after each injection. Snout rubbing and pawing occurred in 70 percent of the observations and imitate the nest building phases described by Fradrich (1974).

Pigs in the environment provided with bedding material showed similar behavior except they collected the material in their mouths or pushed it together with their snouts, to make a nest. One pig consistently made a very large nest 0.5 m x 1.5 m and 15-20 cm high. Another pig although supplied with nesting material with which it played, made an “imaginary” nest like the pigs in the bare environment.

Another feature of the nest building behavior was its intensity (Table 3). From Table 3 it is seen that 3 of the 5 sows showing nest building activities in the bare environment and 5 of the 6 sows in the environment with bedding, showed intense behavior during lactation (post weaning). Two of the 5 nest building sows in the bare environment showed intense behavior during the second oestrus, and 4 of the 6 sows provided with bedding showed similar behavior. Table 3 also indicates the individual differences in nest building behavior of non-pregnant sows.

Discussion

This study shows nest building activity can be induced by PGF2α injection in non–pregnant sows housed in bare pens or supplied with bedding material. In both environments nest building behavior was similar, and followed the pattern of behavior seen in wild pigs (Fradrich, 1974) and in domestic pigs preparing a nest during the 24 hours before parturition (Jones, 1966).

There is a growing awareness of animal welfare as it affects pig production. Emphasis is placed on the provision of an environment which will satisfy the behavioral needs of intensively housed pigs. Farrowing crates without bedding may seem unsuitable for sows but this study suggests that sows will carry out nest building sequences even without bedding material. It is interesting that one sow in the pen provided with bedding material did not use the material but built an “imaginary” nest, while performing the nest building sequences. The main requirement which can be suggested for sows just before parturition is that they have enough space to perform the various nest building behaviors.

During lactation, prolactin plays an important role, and levels of plasma prolactin are elevated at the beginning of an oestrous cycle and towards the end (Hughes and Varley, 1980). The added prolactin release caused by PGF2α adminis-
tration may be responsible for the differences in nest building intensity over the oestrous cycle.

The acute effects of PGF2α on the sow also raise the question of its suitability as a drug to induce farrowing. It is easy to ignore these effects if the end result is achieved. If the welfare of the animal is considered seriously it is important to look at all aspects of drug therapy.

References


Animals Rights—Animal Souls?

Veterinarian L.T. Keenan of Pomona, New York, writing in the Journal of the American Veterinary Medical Association (Vol. 183, July 1, 1983, p. 10) states that he is ‘‘tired of being an animal doctor. I want to become a ‘real doctor.’ This can only be achieved if animals are believed to have souls and the same basic rights as our fellow human beings. Only then can I justify to clients large money outlays for reconstructions, repairs, or treatment modalities. It would help my professional status if an Animal Bill of Rights were to be proposed and eventually made into the law of the land….The sooner this is accomplished, the better it will be for me, my fellow veterinarians, and our fellow animals.”

Intentional introduction of exotic animals can normally be expected to yield unanticipated biological consequences. Single-purpose introductions frequently result in ecological catastrophe. Islands are particularly vulnerable to such assault.

Arctic foxes (Alopex lagopus), released for the purpose of fur farming on the Aleutian Islands formerly devoid of land predators, have significantly altered nesting avifaunal diversity, abundance and productivity. A program for restoring the historic distribution and abundance of critically affected bird species is described. In a long-term study biological control methods are proposed to test the hypothesis that introduced sterile red foxes (Vulpes fulva), apparently a competitively superior species, will markedly reduce or extirpate resident Arctic foxes.

Introduction

Attitudes toward population control of introduced mammals range from regarding them equal or superior to native forms to ir rational hostility toward an introduced species. Most introductions can be viewed as detrimental in some aspect (Roots, 1976). Although population reductions (and the extreme form eradication) may be generally regarded as beneficial, controversy inevitably accompanies the methodologies by which reductions are attempted (Hutchins et al., 1982). Trapping, shooting, exclusion, and poisoning are the traditional methods used in mammalian population control. Novel, often species-specific, methods such as biological control have been introduced into insect and weed control practices but have been rarely attempted in mammal control. One of us has extensively reviewed the many aspects of pest population reduction (Rudd, 1964). The present article describes an example of attempts at eradication of a predatory mammal population in the Aleutian Islands by specific biological means.

The target species is the Arctic fox, Alopex lagopus. Displacement by biological and behavioral means subsumes our methods and purposes. The specific method is generally known as the sterile male technique. Detailed ecological information is vital to biological control of this sensitive character. Especially important is the fact that fox populations to be controlled are only those on small islands (West et al., 1982). Throughout all our work is the background attitude that humane and scientific considerations can be effectively combined, as well described by Kellert (1982).

The delicate balance of natural