Animal Welfare of the Göttingen Minipig

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In the following a short introduction is given to the overall considerations upon how to pursue the best welfare of the minipig. Then specific instructions are given on how to implement and maintain good minipig welfare in every aspect.

The effect of regulation and guidelines is in daily life dependent on the moral and ethics the individual persons in charge of the animals possesses. Therefore it is crucial for the wellbeing of the minipigs that we take the human factor into consideration and keep a good dialogue with everyone around the minipig. A high degree of animal welfare is valuable to both animals and humans and is imperative in performing biomedical research of high scientific value.

It is worth to remember that animal welfare is not only about adjusting a few welfare parameters. It is about taking every single parameter into consideration and optimize. The result is an additive effect. For example an animal in pain will pay only little attention to being placed in a big pen with lots of environmental enrichment. And it will under no circumstances participate in training procedures. Whereas when correctly medicated with analgesics the minipig will enjoy the bedding material and be more confident in personnel and less distressed when handled. The consequence could be more reliable study results and in the end good animal welfare.

So good animal welfare is a matter of being able to turn different welfare buttons and continuously adjust in order to give the optimal conditions for the animals. Examples on this will be given in the following.

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“Need-to-knows” about minipig welfare

The following are indications of how to deal with the minipig as a species; the needs of the minipig regarding housing and husbandry; measuring wellbeing vs. signs of discomfort and pain; anesthesia and analgesia; training of staff and more.

Normal behavior

Minipigs are sleeping a lot of the day away. The most active period is late afternoon and whenever there is human activity in the surroundings. Normal behavior of the minipig when a human enters the pen is that it curiously will come forward and investigate everything new. They are easily startled by noise and sudden changes. Therefore they should be approached with slow movements and a quiet, calm voice.

If minipigs are biting each other or show aggressive behavior it can be a sign of boredom and failure to thrive. Or it could be a sign of general discomfort or even pain. Habituation to the sling, scale and new equipment should proceed slowly and always in combination with treats. Minipigs are smart creatures and will rapidly learn from training as long as they are rewarded properly. Positive reinforcement by clicker training is a possible way of cooperation between animal and staff. Much more of this is covered in the “Handling, Dosing and Training of the Göttingen Minipig” education package.

Acclimatization after transportation

Following transport minimum 7-10 days are required to allow the minipigs to acclimatize to new surroundings and personnel. In this period it is important to establish trust. Interacting with the animal with a gentle voice and scratching behind the ears or elsewhere makes it confident to being handled. It is recommended to have a formal acclimatization programme in place which

Some minipigs can show symptoms of slight diarrhea approximately 7-10 days after housing in new conditions. Therefore some prefer the acclimatization period to be more like 2-3 weeks. The diarrhea can easily be handled with Zoolac® Propaste which are highly concentrated Lactobacillus, Pediococcus and Bacillus species. Antibiotics is of course also an option but usually Zoolac® or alike products does the trick.

Some prefer preventive allocation of yoghurt rich of Lactobacillus and Acidophilus bacteriae. It can be spread over the feed - the minipigs usually eat whatever they are presented to.
Housing

Minimum enclosure size is 2 m². Building new pens measuring 2, 4, 6 m² etc. makes for a flexible solution if single housing is required either throughout an experiment, or intermittently.

<table>
<thead>
<tr>
<th>Weight kg</th>
<th>Minimum enclosure size</th>
<th>Minimum floor area per animal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>2,0</td>
<td>0,20</td>
</tr>
<tr>
<td>5 - 10</td>
<td>2,0</td>
<td>0,25</td>
</tr>
<tr>
<td>10 - 20</td>
<td>2,0</td>
<td>0,35</td>
</tr>
<tr>
<td>20 - 30</td>
<td>2,0</td>
<td>0,50</td>
</tr>
<tr>
<td>30 – 50</td>
<td>2,0</td>
<td>0,70</td>
</tr>
</tbody>
</table>

Placing the defecation area close to the pen door makes it easy to remove faeces. If the water nipple is placed in the defecation area it will encourage the minipigs to urinate and defecate here. Pigs are very hygienic and will avoid soiling in the sleeping area. The back of the pen should be richly provided with bedding material to make a nice sleeping area.

Roofing of the sleeping area and/or a plastic basket with low sides fulfils the minipigs instincts to hide and be in contact with surrounding walls.

Any surface in the pen should be designed in a way that makes it easy to keep clean.

The pens should be designed with bars in between and in the front which allows visual, tactile and olfactory contact with neighbor minipigs.

If the front of the pen is solid wall, the door should be a barrel one with a slightly convex bow toward the aisle. This construction allows the pigs to come forward and have vision of what is going on in the surroundings.

Minipigs are diurnal meaning that management of 12 h light (100 – 200 LUX)/12 h dark complies with their activity pattern.

Room temperature should be at least 20°C. The temperatures below are meant as a guidance – the temperature depends of level of activity, number of minipigs in the pen and amount of bedding.

<table>
<thead>
<tr>
<th>Age</th>
<th>Temperature °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than one month</td>
<td>28</td>
</tr>
<tr>
<td>1 – 2 months</td>
<td>26</td>
</tr>
<tr>
<td>3 – 6 months</td>
<td>22 – 24</td>
</tr>
<tr>
<td>More than 6 months</td>
<td>20 - 22</td>
</tr>
</tbody>
</table>

Take a look at the pigs: clumping together in groups could be an indication of too low room temperature – and the other way around.

Humidity should be around 50 – 70% - ventilation 10-15 changes/hour.

Beware of draught.

For information on how to modify dog pens to house Minipigs see Appendix 1: "Combined Minipig and dog pen for biomedical research."
**Housing in facilities with other conventional pigs or other species?**

Due to the high health standard of Göttingen Minipigs, they should not be housed together with other swine breeds. If other breeds are housed in the same facility, Göttingen Minipigs should be housed in a separate room at a minimum. Staff working with other pigs should avoid coming in contact with the Göttingen Minipigs. If the same staff has to take care of different pig breeds, they should start with the Göttingen Minipigs before working with pigs that have a lower health status. Maintain strict procedures to avoid contamination from tools, feed, carts, footwear etc.

**Single- or group housing**

Minipigs are social creatures and females should (if possible) be group-housed. It is recommended that groups are no larger than 6 individuals.

When introduced to new groups they will fight in order to obtain a social ranking, which normally is established in 30 minutes.

If for some reason the hierarchy will not establish it is better animal welfare to single house the aggressive one or the victim.

If a minipig is once removed from the group it will hardly succeed to get back again.

Establishment of new groups should take place in neutral pens.

A golden rule regarding mixing Minipigs: give plenty of food scattered in the bedding material. It will keep the animals occupied searching for food instead of biting pen mates. It is also possible to give a light sedation of eg. azaperone.

Male Minipigs are generally solitary animals - young male minipigs up to around 1 year can though be kept in groups but it requires that they have been raised in the same group. But again it is important to observe each individual animal in order to evaluate if they are thriving or not.

Male minipigs are sexual mature at 3-4 month – female minipigs at 4-5 months. But it is possible that some of them are sexual mature already from 2 months of age which is indicated by males climbing on each other. Therefore it is advised to separate the sexes to avoid involuntary pregnancies. From the breeder the sexes are separated at weaning.

Single housed minipigs can get frustrated if they can’t keep in touch with mates. Sometimes the study design demands single housing and in these cases it is very important that the staff socialize with each single minipig every day.

Not only will it comply with the need for social contact but also will it keep them confident in human contact in any situation including handling and dosing.

Another way of distracting the minipigs is to let them out in the aisle either individually or in groups. They will love to investigate new “territory”.

**Feed and water**

Minipigs are by nature omnivorous – they will eat anything they come near! They should though be restrictedly fed as they are prone to obesity.

The diet has to be rich in fibers (13-14%) to avoid hunger and still provide satiety.

A minipig feeling hunger will get stressed and may show signs of discomfort and aggressiveness towards pen mates.

Minipigs younger than 7 months should be fed twice daily – older than 7 months once daily.
Total daily amount of feed:

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Weight (kg)</th>
<th>Males (g)</th>
<th>Females (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4</td>
<td>5-9</td>
<td>240</td>
<td>220</td>
</tr>
<tr>
<td>4-6</td>
<td>9-13</td>
<td>240-300</td>
<td>220-280</td>
</tr>
<tr>
<td>6-8</td>
<td>13-17</td>
<td>300-340</td>
<td>280-320</td>
</tr>
<tr>
<td>8-10</td>
<td>17-21</td>
<td>340-380</td>
<td>320-360</td>
</tr>
<tr>
<td>10-12</td>
<td>21-25</td>
<td>380-420</td>
<td>360-400</td>
</tr>
<tr>
<td>&gt;12</td>
<td>25-35</td>
<td>420-600</td>
<td>400-600</td>
</tr>
</tbody>
</table>

In order to control the amount of feed eaten and encourage a healthy appetite, it is recommended that any uneaten feed be removed after one hour. Removing the feed entirely will encourage interest and hunger at the next feeding which are essential for normal feed consumption.

If fed restrictedly the growth rate will exceed with approximately 2 kg pr. month the first year and 1 kg pr. month the next year.

Water should be available ad libitum in drinking nipples to which they are accustomed from the breeder.

Treats of all sorts can be given but be careful if they are high on calories. Minipigs getting fat from too many M&M’s have been reported! And be conscious that minipigs may need some time to get used to new treats.
Bedding and enrichment

Next to food, minipigs has to be offered enrichment to meet the strong urge to root with the snout. And remember: no toys can ever replace bedding and rooting material! Straw in combination with wood shavings are preferred. The feed can be hidden in the bedding which will keep them busy searching for feed. They will love if the food is spread out on the floor in the bedding material which will encourage them to practice rooting behavior.

If e.g. a study design excludes provision of rooting material, toys should be provided. The best toys are those who can be manipulated and decomposed like a towel or something like that. If toys do not meet with the craving for rooting behavior the novelty of the toy lies down quickly.

Health and diseases

The Göttingen Minipigs are microbiologically defined in regard to around 40 pathogens, including bacteriae, virae, fungi, endo- and ectoparasites. Micobiological standardizing is necessary because of the possible interference with experimental results.

Twice a year samples from a number of animals are taken and tested in accordance to FELASA-recommendations. The status of the herd is published in the Health Monitoring Report (HMR) on the homepage of Ellegaard Göttingen Minipigs.

The HMR shows that only a few pathogens have been tested positive and only in a few animals. It is worth having in mind that there have never been any clinical signs of disease in the tested animals or others – except from Candida albicans (a fungus). Candidiasis manifests as a brownish, greasy matter in the head region and around the eyes; some call it "glasses". In spite of the obvious clinical signs the infestation doesn’t seem to bother the minipigs. Customers have reported that they have tried to get rid of candidiasis but usually in vain as it returns.

Candidiasis is a possible zoonotic agent why it is recommended that personnel wears gloves and keeps good hand hygiene.

As mentioned earlier, diarrhea can be seen after housing minipigs in new surroundings. Treatment with concentrated lactobacillus in high concentrations or antibiotics solves the problem.

Some minipigs can get scratches when grouphoused. It can be handled by spraying with a solution of 0,5% chloride hexidine in order to prevent infection.

Because of the high biological and clinical status of the minipigs the use of antibiotics at the breeder is very low – often limited to occasionally treatment of breeding sows in connection to parturition.
Assessment of pain and disease – humane endpoints

Detection and handling of clinical signs in minipigs in research is a very important welfare parameter.

*The well-being and state of health of experimental animals shall be observed by a competent person to prevent pain or avoidable suffering, distress or lasting harm (council directive 86/609/EEC)*

It is crucial in being able to asses suffering, distress and lasting harm that the observer has a thorough knowledge to the normal state of the animal when it is not in pain and is unstressed. Therefore it is important that the people around the animals build up a solid knowledge of normal behavior, expressions (facial, vocal), posture etc. of the minipig.

Reduced food intake or anorexia is the first paramount warning signs. A minipig not eating demands a thorough examination to determine what is wrong. It can be a sign of discomfort or pain due to a test compound or other study-related conditions.

As earlier mentioned altered behavior can be signs of discomfort and pain. Reluctance to get up or move while personnel enters the pen, altered gait and vocalization upon being touched indicates that something is wrong.

In addition to the above mentioned other physiological and behavioural parameters can change indicating acute pain or distress:

- change in temperature, heart rate and respiration
- restlessness, nervousness, salivation/foaming
- inactivity, reluctance to move or get up, hanging posture
- sternal recumbency when lying down
- altered gait, haltered or tiptoeing
- escape behaviour when approached or touched
- ocular and nasal discharge
- vomiting – diarrhea – constipation
- self-induced trauma

A chronic state of pain or distress may be more subtle and difficult to detect. A good knowledge of the normal appearance and behavior of the minipig is especially important to recognize chronic pain or distress.

Weight loss can be a sign of chronic pain and distress – in general weight loss more than 20% is not acceptable.

In nature a weak pig is a dead pig and also minipigs will try to hide being in pain. Therefore it is very hard to scale any sign of pain on the minipig before it stops eating.

An example is the temperature which is normally around 38°C – temperature above 39°C is considered fever. Nevertheless fever is a quite unspecific symptom and should always be combined with other parameters, eg. alterations in appetite, in behavior and reluctance to get up and move around.
**Analgesia, anaesthesia, euthanasia**

Minipigs in pain needs to be treated with analgesics. Usually parenteral administration of NSAIDs is sufficient – acute and heavy pain should be treated with opioids every 6-8 hours. Beware not to administer NSAIDs longer than 3-5 days in terms of avoiding gastrointestinal ulceration.

Aage Kristian Olsen has written the book “Anaesthesia and Analgesia in Ellegaard Göttingen Minipigs” – it is very handy and easily read (50 pages). Best practice of anaesthesia and analgesia in the minipig is to achieve a copy of the book! And make it your own way according to the procedures you are going to perform.

Recovery after surgery: Here the general principles of TLC (tender love and care) are evident. Quiet and warm (up to 30°C) surroundings will fasten the process as minipigs are prone to hypothermia during and after surgery.

Euthanasia must be done on sedated animals eg. with an overdose of pentobarbitone, min. 150 mg/kg strictly IV.
Organisation of animal welfare

There may be a lot of formal arrangements in the institution for ensuring good animal welfare e.g. establishing a local IACUC, insertion of an institutional animal welfare officer, protocols, GLPs and more.

Equally important is the human factor: what vision has the daily personnel on animal welfare? How can they competently provide for animal welfare?
To establish and continue focus on animal welfare regular training of staff must be scheduled.
The meetings should include teaching of new knowledge but even more important sharing of experience between staff members.
Topics to be discussed can be medication, handling, feeding, housing conditions, pain management, behavior, ethics, clicker-training, case-stories, hygiene and more.
The overall aim is to improve the welfare for each individual animal. The way it happens is by ensuring dedicated, trained and caring animal technicians.
References

5. The web page of Ellegaard Göttingen Minipigs: www.minipigs.dk
9. Olsen A.K. Anaesthesia and Analgesia in Ellegaard Göttingen Minipigs. 2010. A copy can be achieved by sending a mail to ellegaard@minipigs.dk or http://minipigs.dk/fileadmin/filer/Publications/Anaesthesia_and_Analgesia_in_Ellegaard_Goettingen_Minipigs.pdf