

Technical Guide

Acclimatisation, Socialisation and Welfare of Göttingen Minipigs



Adrian Zeltner
Ellegaard Göttingen Minipigs
2019

ELLEGAARD • •
GÖTTINGEN MINIPIGS

Table of Contents

Table of Contents.....	2
Introduction.....	3
Contact.....	3
Stress and Stressors.....	4
Change.....	4
Transport.....	4
Unpredictability and Novelty.....	5
Invasion of personal space.....	5
Noise.....	5
Boredom and Isolation.....	5
Acclimatisation Period.....	6
Health Issues after arrival.....	7
Socializing.....	7
General Minipig Behaviour.....	10
Housing.....	11
Legislation and regulatory guidelines.....	11
Single- or Social Housing.....	12
Housing in facilities with conventional pigs or other species.....	12
Pen design.....	12
Climate, Bedding material, Food and Water.....	14
Light.....	14
Temperature.....	14
Air.....	14
Bedding.....	14
Nutrition and water.....	15
Enrichment.....	16
Health and diseases.....	17
Assessment of pain and disease.....	18
Common diseases.....	19
Pain scoring.....	19
Analgesia and anaesthesia.....	19
References.....	20

Introduction

This text focuses on the time after the Minipig has arrived at your facility until the start of experimental procedures. Apart from general considerations regarding a beneficial acclimatisation period, specific instructions – including suggestions for a socialisation programme – are provided.

Even if you have experience with Minipigs it might provide you with a hint or a tip that is useful. Sometimes it is also worth looking at your routines, reconsidering some aspects and discussing whether there is room for improvement. It is often small improvements that can make a difference.

The overall purpose is to help you find the best possible welfare and conditions during the acclimatisation period and at the same time to make the most efficient use of this phase regarding socialization and preparing the Minipigs for the study.

We wish to emphasise that good acclimatisation is NOT a matter of leaving Minipigs in peace without any disturbance. Acclimatisation is an active process where the animals are gradually accustomed to experimental conditions in a way that accounts for their wellbeing. This involves an active input from the animal caretakers, biotechnicians as well as from the attending veterinarian. Interaction, socialising and training is all part of that. This will make the animals easier to handle during experiments and ultimately contribute to improved study results.

Any time and effort you invest in the acclimation period will be paid back with divided when the study starts.

Successful acclimation can only be achieved when the Minipigs are housed under appropriate conditions and have suitable pens and their environment is aptly enriched. We share our in-house experience in this field, as well as the feedback we had from our partners and customers, so you may adjust your housing facility. If you have any improvements that you would like to share, we would be happy to hear from you, so your feedback might be added to the next update of this paper.

Understanding Minipig behaviour is essential for a fruitful acclimation and a positive outcome of the study. We have included a chapter on this topic, but we would also like to refer to the Technical Guide: Handling Dosing and Training of the Göttingen Minipig.

Contact

For further information please contact the author at: az@Minipigs.dk

Stress and Stressors

Stressors are factors that lead to stress in animals. Stress is generally not desirable, but it is important to recognize that stress does not always have adverse consequences (Dhabhar et al. 2010)¹, Mendl, M. (1999)² Stress can be acute or chronic, whereas the later should be avoided at all costs. Significant is how the Minipigs can cope with unavoidable short-term stress and return to comfort rather than distress. (Brown and Gade 2012)³.

The acclimating period is all about helping the Minipigs to overcome effects stress that has already occurred, cope with stress that the new environment brings and prepare them for the new stressors that might arise during the study.

The following are some of the most important factors that might cause stress, but others should not be excluded in your overall consideration.

Change

Like most animals, Minipigs perceive major changes in their environment as stressors. Therefore, any change in a minipig's environment should be introduced as gently as possible. At Ellegaard's breeding facilities, the first big change in a minipig's life is being weaned from the mother sow. Later in life, it may be logistically necessary to relocate the minipig within the barrier facility, including to introduce it to a new group. The social hierarchy among Minipigs is significant, and the process is undoubtedly stressful for the individual minipig, even if it is only being moved to a neighbouring pen.

A drastic change in a minipig's life it is to be removed from its normal environment, transported and then introduced to a new facility where everything is foreign: pen, bedding, food, pen mates, neighbours, staff, smells, sounds, etc.

These changes are likely to be perceived as possible stressors which can influence the general condition of the individual minipig.

Another change the Minipigs will experience is to be part of the study. At Ellegaard they are not involved in any procedures that resemble any study. They live in groups with other Minipigs of the same gender and similar age. Their daily routines are sleep, eat, root, play and interact with each other.

Transport

There are numerous publications elaborating on the physiological changes due to transport on pigs and other farm animals. This includes changes in their cardiovascular, immune, endocrine and central nervous systems. Factors contributing to this are: Change, Vibration, Noise, isolation, fear or anxiety. The parameters normally return to baseline within a couple of days.

Transporting Minipigs is not different and Ellegaard has considered every aspect of the process to make it as pleasant and gentle as possible. They have a controlled environment under transport, however there is limited space. The Minipigs are fed on longer trips and water is continuously provided on all transports. Evidently, they do not drink much during transportation, therefore a slight dehydration could be possible at the time of arrival.

After arriving at the destination, the unloading should be as gentle as possible by avoiding unnecessary bumps, shocks and stressful conditions.

The lid of the transport cage is difficult to remove, which poses a challenge to getting the pig out of the box. If the box is assembled with cable binders, you can cut them and take the lid off. The ideal situation would be, to place the open cage inside or outside the pen and wait for the pig to leave on its own desire. Time does not always allow for this to happen. If so, you might as well get it over with as quickly as possible by lifting the minipig out of the cage and save your energy and efforts for other activities that may be more beneficial to overall minipig socialisation.

Unpredictability and Novelty

Unpredictability and novelty can cause stress. To which degree this occurs depends a lot on the individual Minipig and its temperament and on the nature of these factors.

Minipigs like routines, they are clever and pick up clues to predict what happens next from their environment and the actions around them. They are very curious and very interested what is going on around them. Let them see the activities they hear and smell; let sniff at new objects in a non-threatening way. Minipigs like investigating new objects but, as total predictability can lead to boredom, novelties can also wear off quickly and the objects (toys) become boring. (Sambrook et al. 1997)⁴

Invasion of personal space

Minipigs like most animals of the Artiodactyl order have a flight zone. This could be considered personal space and if a person enters this zone the animal will escape or try to do so. An animal's flight zone will vary depending on how calm or how tame it is. The flight zone gets bigger when an animal becomes excited. It also increases when the person moves and there is a correlation to the speed of the movement. Your first efforts should be concentrated on reducing this flight zone or with other words gain the trust of the Minipigs. (Grandin T. 2014)⁵

Noise

Minipigs are quite noisy animals themselves and are generally not very sensitive to background noise. There is not much literature around as to which degree sound affects pigs in either a positive or negative way. Some constant noise in certain frequencies might cause stress, but it is certain that unexpected and unknown sounds startle the Minipigs. As prey animals, they react to sudden changes in their environment and if this happens frequently it can lead to stress.

Boredom and Isolation

The lack of stimulation, just as too much of it, is a stressor. Minipigs need to satisfy their behaviour need to root and explore. Adequate confrontation of novel objects that can be manipulated and chewed on help to avoid stress. But as mentioned above, the novelty of toys wears off quickly so they should be changed out regularly.

As pigs are flock animals and single housing with no contact to companions is stressful and not natural. On the other hand, pigs have also a hierarchy in the group and unconsidered grouping or pairing can be just as stressful if there is no harmony. Therefore, it is possible that in certain cases it is better welfare to house them single.

Acclimatisation Period

The purpose of the acclimatisation period is:

- to give the Minipigs a window to recover from the transport
- stabilise physiological parameters
- get the animals used to the new environment
- adapt to routines
- socialise the animals
- gradually accustom them to the experimental conditions
- minimise stress for animal and staff alike
- build a relationship with handlers

There is always an acclimation period, the length of which depends on company policy or type of study. 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. It is recommended to have a formal acclimatization programme in place.

A rough outline of a socialisation programme could look like this: (Ellegaard et al. 2010)⁶

- Step 1 (Day 0): The new arrivals are left for a 2-5 h to settle; the technicians have minimal interaction with the new arrivals as they tend to be nervous.
- Step 2 (Days 0-5): The technicians approach the pen with a food reward (diet/apples) and wait until the pigs come to them for the reward. Food reward must be used with caution. Once the Minipigs take their reward, technicians may enter the pen and let them get closer. Next step is to start touching the pigs to accustom them to physical contact with humans.
- Step 3 (Days 2-8): The pigs are trained to be handled by picking them up; this is carried out in the pen and performed a couple of times a day – this gets the pig used to human interaction, touch and being handled. Each time the pig is handled it should be given a verbal and/or patting reward, and can, after a full procedure, be given a food reward. The animals are trained to walk up and down the corridors in the pig bays and to step onto a balance in the procedure room. A verbal and/or patting reward should be given on performance of the required behaviour; alternatively, a food reward can be given.
- Step 4 (Days 2-X): Training for blood sampling or other procedures can be started as soon as the pig is comfortable being picked up and carried. The pig is walked to the procedure room and restrained as for the expected procedures in the upcoming study. That might be on its back for bleeds, sitting for gavage or in the sling. The pigs receive a lot of positive physical contact and verbal praise. A food reward is given each time after having been to the procedure room (if the research protocol allows it).

Acclimation should not be regarded as idle time. In fact, during acclimation, we can already set the switches for easy handling and a successful study. It pays to make good use of the acclimation period (Tsutsumi 2001)⁷. Leaving animal alone in this time is not acclimation. Pigs are motivated to have visual and physical contacts with humans and refusal to have physical interaction and/or eye contact is aversive for most pigs. (Terlouw 2005)⁸.

Health Issues after arrival

At some time after arrival, the Minipigs should be clinically examined. Do this at a time and in a fashion to avoid stressing the animals too much. Depending on the number of Minipigs and routines of the institution it might be done at the time of unloading, but if this phase busy and hectic leave it for a later stage. We only ship healthy animals and experience shows that their health status does not change significantly under transport. If there are no obvious signs ill health or abnormal behaviour the clinical examination can be performed a few days later when the Minipigs have settled.

Possible infectious diseases or diarrhoea due to the new environment will typically show up during the first week and are incompatible with the experimental set-up. Whether this happens or not depends a lot on the microbiology of the new milieu or whether there are other pigs in the vicinity.

For these reasons, it makes sense to recommend at least two weeks of acclimatisation.

Some Minipigs can show symptoms of slight diarrhoea approximately 7-10 days. The diarrhoea can easily be controlled with probiotics like Zoolac® Propaste or Pro-Kolin which contain highly concentrated Lactobacillus and Pediococcus Bacillus species.

Preventive allocation of yoghurt or yoghurt drinks, rich in Lactobacillus and Acidophilus bacteria can be considered to stabilise the intestinal microflora. This can be spread over the normal Minipig diet or given from a large syringe. It might take some convincing to have the Minipigs feeding from the syringe but as the products are sweet, they will love to come back for more once they have figured it out. Medication can be mixed in, if it is prescribed and compatible with the yogurt product.

A course of antibiotics might be necessary to treat severe infections.

During the first week, preventive medication and vaccination can be prescribed as well.



Socializing

Minipigs are socialized to a certain point at our facility but more of it is needed to adapt them the procedures related to the study. As mentioned under the previous chapter you need to let them settle and get over the inconveniences of the transport. Give them peace and time to sniff around and become familiar with their new environment. Then you need to gain their trust and reduce the flight zone before you can introduce them to procedures.

Your first efforts should be concentrated on reducing this flight zone or with other words gain its trust. Feeding time provides a good opportunity to start socializing as this is a situation where they naturally get a reward. Remember that we are dealing with prey animals, so most likely it will be shy and wary, maybe even a little frightened. Move slowly when you are around pigs and do not make abrupt movements, as this will frighten them. Squat to seem less imposing and talk to the pig in a low, pleasant and encouraging voice. Throw a food pellet or treat to encourage it to come closer. Pigs are curious and inquisitive as well, so offer a hand to sniff as well. Do let the pig come to you rather than the opposite. It takes a while to gain enough trust so that you can touch the animal. At first, Minipigs do not like to be patted, but once they trust you,

they love to be scratched, sometimes quite roughly with fingernails behind the ear or on the back. A gentle belly rub will be appreciated as well and tender fondling of the cheek shows your trust towards the Minipig. But be careful, because a frightened or frustrated animal might try to bite you in the latter situation. Keep in mind that they are individuals and not all of them might like or enjoy the same thing.

If you have a formal training programme for Minipigs, start as soon as the Minipigs are not afraid anymore and eat the treats they are offered. This might not occur at the same time for all animals in the group. Even if you do not have a training schedule, it is advisable to desensitise the Minipigs to the upcoming procedures: If a pig must be carried, then accustom it to being picked up and held on the arm; or if you need to take a blood sample, then train it for being placed on the V-trough, and so on.



You can learn more about animal training and habituation from our Technical Guide: Handling Dosing and Training of the Göttingen Minipig.

The main points are:

- Every contact with an animal is a training situation
 - we train the animals whether we are aware of it or not, intended or not.
- The first experience (with a thing or person) becomes the rule – subsequent different experiences are considered the exception
 - make a good first impression and introduce new things gently
- Reward desired behaviour only and reward for a purpose.
 - If the animal vocalises when you pick it up, do not put it down immediately, otherwise you reward squealing and teach the Minipig to vocalise to be put back down. The appropriate action is to use a gentle voice to calm the animal (like a baby) and give a food reward as soon as the noise stops.

Whenever you are dealing with Minipigs, you should create a pleasant, undisturbed atmosphere: make it easy for everyone, set up the situation to succeed and take account of the hearing and visual capacities of the Minipig. Handle the animal with confidence and certainty but be gentle and caring at the same time. Remember pigs have a hierarchy and you are part of it. As the alpha, you need to give the Minipigs assurance and clear guidance, and in this sense staff training is just as important as Minipig training. To be successful all staff have to adhere to the same protocol.

If you have many Minipigs in your care, it would be advisable to keep records of the progress with socialisation in the acclimation phase. This will allow you to make the best use of your resources by concentrating the efforts where it is needed most. There will always be differences in character, temperament and behaviour in a group of Minipigs. Spend more time with the animals that are a bit behind or not as relaxed and friendly as others. The following table is a suggestion to record socialization and other welfare activities during acclimation. You can adjust it to your needs and include the progress in adaptation to procedures.

General Minipig Behaviour

Minipigs are clever, curious and social animals, but can be shy and weary as well. The social activities are not only directed to their pen mates but towards human beings as well. They are easily startled by sudden noise, movements or changes in their environment. Therefore, they should be approached with slow movements and a quiet, calm voice.

Minipigs are sleeping a lot during the day. It depends a bit on the schedule around them when what time of the day they are sleeping. Typically, they will have a specific resting site and huddle up when sleeping or resting. The most active period is whenever there is human activity in the surroundings and around feeding time. Rooting and browsing are feeding behaviour in pigs and it might carry on for quite some time after feeding. Rooting is a specific pig behaviour they need to be able to express to ensure their wellbeing. Pigs are strongly motivated to explore environments: rooting, chewing and checking scent are examples of exploratory behaviour and, as with rooting; pigs will spend a lot of time on these activities.

Normal behaviour of the minipig, when a human enters the room, is to come forward in pen and investigate. When entering the pen, they may move backwards and take their distance but if they are well socialized, they will be curiously and will come forward to interact.

Sexual behaviour includes males using their snouts to push the side of female pigs, resting the head on the back of others and mounting. This behaviour is exhibited by pigs as young as 5 weeks old. Males 'ride' each other; presumably this behaviour has an element of practice but is principally related to status. Boars are indiscriminate and will attempt to mount sows regardless of whether they are in oestrus. They will also mount lower ranking males. Thus, mounting behaviour will not disappear from a group of pigs with age.

Abnormal behaviour tends to appear when the environment is inappropriate. In domestic settings, stereotypical behaviour such as bar biting (where pigs close their mouths over the bars of their housing and run their heads repeatedly from side to side) are believed to have developed as a result of frustrated foraging behaviour. Where pigs are overcrowded, they may initiate tail-biting and belly-nosing (persistent rooting the snout into the belly of another pig in the pen, prolonged and potentially injurious, and differs from sexual 'nosing' due to persistence). Tail-biting is also believed to be associated with impoverished environments and may result from frustrated exploratory behaviour. If Minipigs are biting each other or show aggressive behaviour it can be a sign of boredom and failure to thrive, but it could be a sign of general discomfort or even pain.

Pigs have a linear hierarchy in their group which, once established, is generally quite stable, but for various reasons rearranging can happen. This is accompanied by fighting and aggression. Hierarchy is usually regulated by avoidance; getting out of the way of the dominate animal. Therefore, it is important to give enough space when regrouping Minipigs or when hierarchical fights break out.

Minipigs can be quite noisy and have a rich repertoire of vocal signals, there might be up to 20 different signals. The grunt is one of the most common sounds, given in response to familiar sounds or while looking for food (rooting). A short grunt is given when the pig is excited, while a long grunt is a contact call and normally associated with pleasurable stimuli. When pigs are aroused, or anticipated they may squeal, and they may scream when hurt. Squealing occurs as well when they are unhappy with a situation for example when they are picked up and handled. Some theories claim that screaming is a congenital, lifesaving mechanism for piglets to prevent them from being crushed to death by the mother sow. The screaming when being handled rarely has anything to do with pain or discomfort but more like an expression of their general discontent of the situation.

Housing

Minipigs, like all pigs are social animals and prefer to be socially housed, however there is a hierarchy and therefore special attention must be given to compatibility.

Pens are preferable to cages; floors should be solid and of medium grit to provide secure foothold and to keep the Minipig hooves trimmed. Floor sloping should be from the back wall towards the front. Water nipples should be placed in the front as well so that excess water does not run back into the pen. Minipigs prefer to sleep in the back part of the pen, make sure it is dry and warm and divisions are solid in that part. Divisions need to be at least 1.2m high as Minipigs can climb or jump higher than expected.

It is important to have a sturdy construction as Minipigs will explore and manipulate all that can be manipulated, and destruction can be the result. Minipigs develop a dunging pattern and will defecate as far as possible from where they are fed, frequently the defecation area will be developed near the watering area or other wet areas.

Good ventilation and climate control need to be provided.

Legislation and regulatory guidelines

Please consult with the legislation relevant in your area.

Hosing in Europe is regulated by DIRECTIVE 2010/63/EU ANNEX III :

Animals, except those which are naturally solitary, shall be socially housed in stable groups of compatible individuals. In cases where single housing is allowed in accordance with article 33(3) the duration shall be limited to the minimum period necessary and visual, auditory, olfactory and/or tactile contact shall be maintained. The introduction or re-introduction of animals to established groups shall be carefully monitored to avoid problems of incompatibility and disrupted social relationships.

The AAALAC guide states that single housing of social species should be the exception. Social housing is considered by AAALAC as the default method of housing unless otherwise justified based on social incompatibility resulting from inappropriate behaviour, veterinary concerns regarding well-being or scientific necessity approved by IACUC (or a similar animal-welfare body)

Minimum enclosure size is 2 m². (Source : DIRECTIVE 2010/63/EU ANNEX III)

Weight kg	Minimum enclosure size	Minimum floor area per animal
< 5	2,0	0,20
5 - 10	2,0	0,25
10 - 20	2,0	0,35
20 - 30	2,0	0,50
30 - 50	2,0	0,70

Single- or Social Housing

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

When forming new groups Minipigs will fight in order to obtain a social ranking, which normally is established in 30 minutes. Severity and duration increase with age. If for some reason the hierarchy will not establish it is better animal welfare to single house the aggressive one or the victim.

An important factor for establishing harmonious groups/pairs is mentality and previous ranking. There will be less conflict when pairing a dominant and a submissive animal compared to two dominant individuals.

Establishment of new groups should take place in neutral pens. Give plenty of space and have some diet scattered in the bedding material. It will keep the animals occupied searching for food instead of biting pen mates.

If a minipig is once removed from the group for a longer period, it will be difficult to successfully introduce it back again. It is often easier to reintroduce a dominant rather than a submissive animal to the group. However, it is not easy to spot dominant Minipigs in a group.

Adult, sexually active male Minipigs are generally solitary animals - young male Minipigs up to around 1½ year can though be kept in groups but it requires that they have been raised in the same group.

At the breeder, the sexes are separated at weaning (Male Minipigs are sexual mature at 2-4 month - female Minipigs at 4-6 months) and kept in groups after that. To help you establishing pairs/groups you can check the label on the transport to identify the Minipigs that have been in the same group at their origin.

Single housed Minipigs can get frustrated if they can't keep in touch with mates. If the study design demands single housing 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. It is equally important that they have visual, auditory, olfactory and tactile contact to conspecifics.

Housing in facilities with 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 contact with the Göttingen Minipigs. If the same staff must take care of different pig breeds, they should start with the Göttingen Minipigs first and then attend to pigs with a lower health status. Maintain strict procedures to avoid contamination from tools, feed, carts, footwear etc.

Göttingen Minipigs are born and raised in a barrier and therefore one would expect a weaker immune defense and some complications when exposed to an environment with a lower hygiene status. Practical experience has shown that there is no reason for concern when housing Göttingen Minipigs in a conventional setting. In some cases, due to the different microbiology, some incidences of diarrhea have been observed. This can usually be treated with probiotics, or probiotics can be given prophylactic.

Housing Minipigs with other species in the room should be avoided.

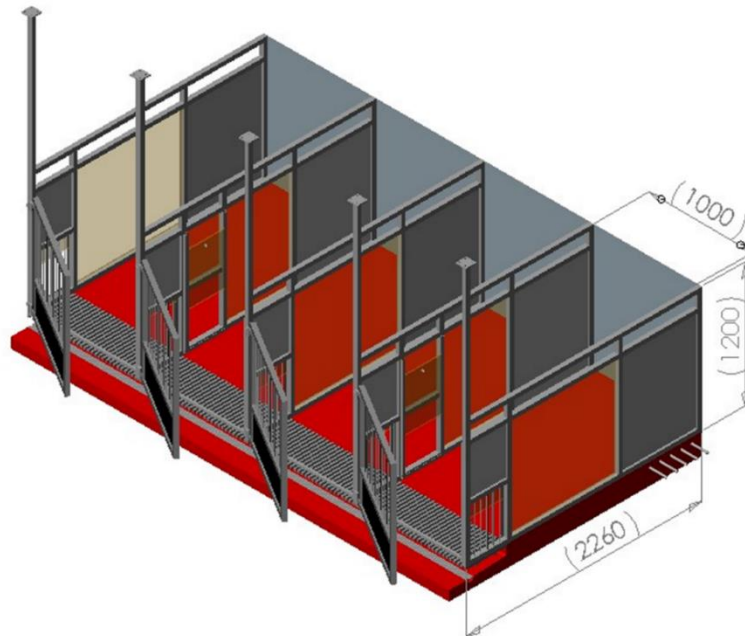
Pen design

Ideally the pen is rectangular, and the floor has a fall from the wall to the front of around 3°. The narrow sides of the pen should be in front and in the back. The back of the pen will be the preferred resting area therefore the rear half of the pen should have solid panels with tight connection to the floor and back wall. Roofing of the sleeping area and/or a plastic basket with low sides fulfills the Minipigs instincts to hide and feel secure when resting. The back of the pen should be richly provided with bedding material to make a nice sleeping area.

The side walls in the front should be designed with vertical bars which allow visual, tactile and olfactory contact with neighboring Minipigs.

Pigs are very clean and will avoid soiling in the sleeping area by choosing a defecation area away from it. Placement of the water nipple is important as to where you want to encourage the Minipigs to urinate and defecate as a wet area is often preferred for this purpose. Water nipples should be height adjustable to match the shoulder height of the residents.

Trying to place the defecation area close to the pen door makes it easy to remove faeces. Water should be provided in the front as well, to have excess water running off to the aisle and keep the rest of the pen dry.



Example of Minipig pens with small area of slated floor in front. Suggested length and width is for a minimum size pen. They can be combined by a hatch for larger groups or built with a larger width. The height should not be lowered.



For the best welfare of animals and staff it is important to observe that the materials used do not make loud noise when moved or touched by the animals. The walls and ceiling materials should also be chosen in regard to acoustic properties. No sharp edges or protruding bolts should be present. If any walls are made of concrete or brick it is important to have a strong surface to protect the lower 100 cm of the wall. The surface can be either a very durable epoxy or a 1-2 mm thick panel of stainless steel bolted or glued to the wall. Minipigs can be fed on the floor, if a food bowl is used it should be able to be fixed securely in place. Bedding, bite nipples (or similar) and a chain (3 cm links) should be supplied as a standard. Further enrichment is discussed later.



Climate, Bedding material, Food and Water

Light

Minipigs are diurnal, a setting of 12 h light (100 – 200 LUX) and 12 h dark complies with their activity pattern. A nice touch would be to dim the light before it goes off gradually and likewise when it is switched on again.

Temperature

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 and so on. Observe the pigs: clumping together in groups could be an indication of too low room temperature – and the other way around.

Age	Temperature °C
Less than one month	28
1 – 2 months	26
3 – 6 months	22 – 24
More than 6 months	20 – 22

Air

Humidity should be kept between 50 – 70% - ventilation at 10-15 air changes/hour. Beware of draught.

Bedding

Minipigs should be provided with bedding or rooting material. At Ellegaard, they are used to chopped straw, but any other material which satisfies their natural urge to root will be appreciated. Straw is the optimal bedding but wood shavings and sawdust, especially when enriched with hay will be fine as well. Please note that bedding will be ingested, which in case of straw is acceptable but ingested wooden materials might lead to constipation.



Nutrition and water

Minipigs are by nature omnivorous – they will eat almost anything and they especially like sweet stuff. To keep the Minipigs lean, restrictive feed is necessary as they are prone to obesity.

The diet should be rich in fibers (13-14%) to avoid hunger and still provide satiety. A specially designed Minipig diet is recommended and most suppliers of laboratory diet will be able to provide it.

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

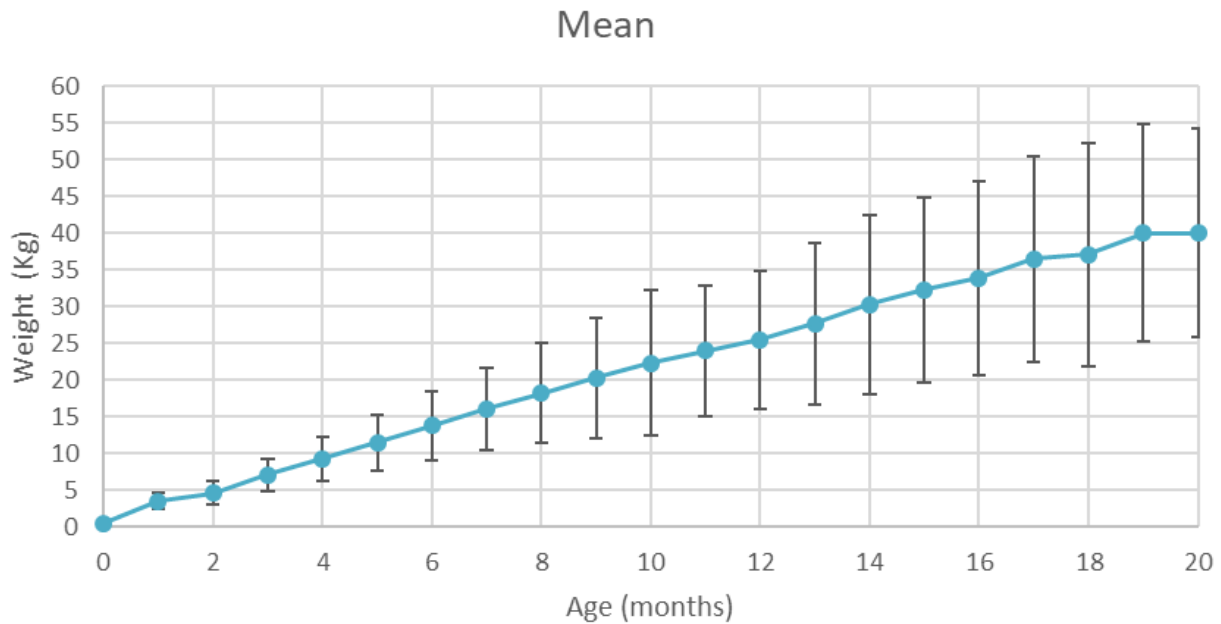
Minipigs younger than 7 months should be fed twice daily – one ration per day works for Minipigs older than 7 months.

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.

Water should be provided from drinking nipples, bowls are acceptable as well, but it is difficult to keep the water clean and it must be changed frequently. The drinking nipples should be at around shoulder height of the respective Minipigs. The height might need to be adjusted as the Minipigs grow.

The following table is a guideline to a feeding regime with Minipig diet. It is important to weigh the animals regularly and judge them visually to ensure that the ration is correct. Adjust when necessary.

Age (months)	Weight (kg)	Males (g)	Females (g)
2-4	5-9	240	220
4-6	9-13	240-300	220-280
6-8	13-17	300-340	280-320
8-10	17-21	340-380	320-360
10-12	21-25	380-420	360-400
>12	25-35	420-600	400-600



Göttingen Minipig Growth Curve

The vertical lines indicate the 95% reference range which presents the prediction interval between which the weight of 95% of the Minipigs falls into. A minimum of normal Minipigs are beyond the lower/upper limit of this interval.

Enrichment

As a minimum you should provide rooting material and bite nipples or chains. As Minipigs are very inquisitive they will enjoy toys of all sorts, but in most cases the novelty wears off quickly and they are not used anymore. That means they need to be replaced often, and it is important to check if the toys are played with. Interesting are toys that will change shape or pieces can be bitten off, but please check with your study protocol what is acceptable. (wood pins, ice blocks, cardboard boxes, bite nipples etc.)

Toys that contain food or have an appealing scent are especially attractive. (food balls, frozen fruit, ice blocks containing food, Porcichew[®] etc.)

Providing water to play with is popular and Minipigs enjoy a lukewarm shower as well.

Apart from adding different things to the pen you could consider providing a separate play area/room where lots of different distractions, from toys, balls to obstacles that can be climbed or used as tunnels are on offer. This could be indoors as well as outdoors.

Another option of enrichment is providing space to go exploring and maybe have snout contact other Minipigs. This could be the corridor in the housing unit.

If you can offer distinctive microclimates, it would give the Minipigs a choice of temperature control.

Personal interaction not only makes the Minipigs easier to handle, it is also enrichment. Training Minipigs with clicker or other means does not only get the Minipigs to participate in the study process actively it is also considered fantastic enrichment as the animals are mentally stimulated and let to succeed in a challenge. Korte et al. (2007)²⁰, Mendl, M. (1999)²¹ See also the Technical Guide: Handling and dosing of the Göttingen Minipig.

Health and diseases

The Göttingen Minipigs are microbiologically defined by testing them regularly for around 40 pathogens, including bacteria, viruses, fungi, endo- and ectoparasites. Microbiological standardizing is necessary because of the possible interference with experimental results.

Twice a year samples from several animals are taken and tested in accordance with 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. There have never been any clinical signs of disease in the tested animals or others – except from *Candida albicans*. Candidiasis can manifest as a reddish brown and crusty discharge is commonly observed in older Minipigs. The discharge occurs usually bilateral and is neither associated with conjunctivitis nor seems the drainage of the tears through the nasolacrimal system compromised. The aetiology of the condition is not known, but it is described in other miniature breeds ([https://www.minipiginfo.com/mini pig ear and eye care.html](https://www.minipiginfo.com/mini_pig_ear_and_eye_care.html)) and land-race. (H. Telkänranta 2015)⁹ Bacteriological examinations are usually negative. The discharge is best left in situ as the animals do not seem to be affected by it and removal and cleaning of the crusts may only lead to irritation of the underlying skin.

Treatment with Saniotic Vet. (miconazolniträt + prednisonacetat + polymyxin B) in early stages gives temporary relief but when stopped it will reoccur again.

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

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

If there is a high risk of infectious diseases in the area and a high standard of biosecurity cannot be guaranteed, you may want to consider vaccinating the Minipigs.

Some Minipigs can get scratches when group housed. It can be handled by spraying with a solution of 0,5% chlorhexidine 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

Detection and treating of clinical signs in Minipigs in research are 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 (Directive 2010/63/EU)

It is crucial in being able to assess 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 not stressed. Therefore, it is important that the people around the animals build up a solid knowledge of normal behaviour, 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.

Keep in mind, that female Minipigs have a reduced intake of food during oestrus, this is quite normal and can occur to a various degree.

As earlier mentioned, altered behaviour 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
- in certain conditions hyperactivity
- sternal recumbency when lying down
- altered gait, haltered or tiptoeing
- stiffness of limbs
- snuffling and coughing
- frequent change of posture and convulsions
- escape behaviour when approached or touched
- ocular and nasal discharge
- vomiting - diarrhoea - constipation
- self-induced trauma

Body temperature can naturally vary a lot and can rise to 39°C in healthy Minipigs. By itself it is a poor indicator regarding the health of the animals.

Common diseases

The most important infectious diseases to be aware of are covered by the FELASA guidelines for health monitoring (Rehbinder et al. 1998)¹⁰

Useful handbooks covering diseases in pigs are Taylor (1999)¹¹, Waldmann & Wendt (2004)¹², Heinritzi et al. (2006)¹³ and Straw et al. (2006)¹⁴.

Suboptimal housing conditions can result in disease. For instance, it is important to have dry, clean areas in the pens to avoid dermal problems; well-socialized groups to avoid fighting-related wounds; optimal temperature and air change to avoid respiratory problems; and optimal diet and feeding guidelines to avoid over-/under-weight and diseases such as gastric ulcer. Finally, as mentioned above, it is important to have clean and disinfected pens when receiving new animals - or the animals will be at increased risk of developing diarrhoea shortly after arrival. Such a diarrhoea problem can also result from cross-contamination if pigs with another - typically lower - status are housed next to ones with a high health status. And albeit it seems harmless with a short period of diarrhoea, this can have significant impact on the animals for a long period, as reflected in for instance the levels of acute phase proteins (Christoffersen et al. 2015)¹⁵.

Pain scoring

Pain scoring can be difficult as Minipigs do try to hide that they are in pain. Most significant is the absence of normal behaviour. That makes acute pain easier detectable than chronic pain.

A chronic state of pain or distress may be subtler and more difficult to detect. A good knowledge of the normal appearance and behaviour 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.

The position of the tail is a very good indicator of the general wellbeing as well. Göttingen Minipigs for example have a strait tail that hangs down in neutral position, is wagging when happy, up when alert and between the legs when unwell, scared submissive or unsure.

Abbie V. Viscardi et al. (2017)¹⁷ have developed a pig grimace scale for pain assessment which might help.

Analgesia and anaesthesia

Minipigs in pain needs to be treated with analgesics. Considerable individual variation in required doses may be encountered. Therefore, it is important to assess analgesic effect frequently and adjust, regarding product or dose, if necessary.

Parenteral administration of NSAIDs is recommended for light to moderate pain. Be aware that administering NSAIDs longer than 3-5 days may cause gastrointestinal ulceration. Useful products are:

Meloxicam	0,4mg/kg iv, sc, im, PO	once daily	
Flunixin meglumine	1-2mg/kg iv, sc, im	once daily	
Carprofen	2-4mg/kg iv, sc, im	once daily	Flecknell (2015) ¹⁸

Acute and severe pain should be treated with opioids. Most common used are.

Butorphanol	0.1-0.3mg/kg iv, sc, im	4 hourly	
Buprenorphine	0.01-0.1mg/kg iv, sc, im	6-12 hourly	Lumb&Jones (2007) ¹⁹

Higher doses are recommended for major surgical procedures. Fentanyl patches have also been successful used in post-surgical analgesia.

For Aesthesia please refer to the booklet: *Anaesthesia and Analgesia in Ellegaard Göttingen minipigs* by Aage Kristian Olsen Alstrup. (available from Ellegaard Göttingen Minipigs)

or contact us at ellegaard@minipigs.dk

References

1. Firdaus S.Dhabhar, et al. *Short-term stress enhances cellular immunity and increases early resistance to squamous cell carcinoma*. Brain, Behavior, and Immunity Volume 24, Issue 1, January 2010, Pages 127-137
2. Mendl, M. (1999). *Performing under pressure: Stress and cognitive function*. Applied Animal Behaviour Science, 65(3):221{244.B
3. Brown L. D., Gade L. G., *Stress issues in Porcine Research*. The Minipig in Biomedical Research. CRC Press 2012, ISBN: 978-1-4398-1118-4
4. Sambrook, T. D. and Buchanan-Smith, H. M. (1997). Control and complexity in novel object enrichment. *Animal Welfare*, 6:207(2016)
5. Temple Grandin, Mark J. Deesing, in *Genetics and the Behavior of Domestic Animals (Second Edition)*, 2014
6. Ellegaard L. et al. *Welfare of the minipig with special reference to use in regulatory toxicology studies*. Journal of Pharmacological and Toxicological Methods 62 (2010) 167-183
7. Tsutsumi H, Morikawa N, Niki R, Tanigawa M., *Acclimatization and response of Minipigs toward humans*. Lab Anim. 2001 Jul;35(3):236-42.
8. Terlouw E.M.C. and Porcher J., *Repeated handling of pigs during rearing. II. Effect of reactivity to humans on aggression during mixing and on meat quality*. J. Anim. Sci. 2005; 83:1664-1672
9. H. Telkänranta, J. N. Marchant-Forde and A. Valros. *Tear staining in pigs: a potential tool for welfare assessment on commercial farms*, doi:10.1017/S175173111500172X
10. Reh binder, C., Baneux, P., Forbes, D. et al. (1998) *FELASA recommendations for the health monitoring of breeding colonies and experimental units of cats, dogs and pigs*. Report of the Federation of European Laboratory Animal Science Associations (FELASA) Laboratory Animals, 32, 1-17
11. Taylor, D.J. (1999) *Pig Diseases*, 8th edn. D.J. Taylor, Glasgow
12. Waldmann, K.-H. and Wendt, M. (2004) *Lehrbuch der Schweinekrankheiten*, 4th edn. Parey Verlag, Berlin
13. Heinritzi, K., Gindele, H.R., Reiner, G. et al. (2006) *Schweinekrankheiten*. Uni-Taschenbücher, Stuttgart
14. Straw, B.E., Zimmerman, J.J., D’Allaire, S. et al. (2006) *Diseases of Swine*, 9th edn. Blackwell Publishing, Oxford
15. Christoffersen, B.O., Jensen, S.J., Ludvigsen, T.P., et al. *Age- and sex-associated effects on acute-phase proteins in Göttingen Minipigs*. Comp Med, 65, 333-341
17. Abbie V. Viscardi, Michelle Hunniford, Penny Lawlis, Matthew Leach and Patricia V. Turner, *Development of a Piglet grimace scale to evaluate Piglet Pain Using Facial Expressions Following castration and Tail Docking: a Pilot study*, doi: 10.3389/fvets.2017.00051
18. P.A. Flecknell, *Laboratory Animal Anaesthesia*, 4th Edition, (2015), Elsevier
19. Lumb&Jones, *Veterinary anesthesia and analgesia*. 4th Edition Blackwell publishing 2007
20. Korte, S. M., Olivier, B., and Koolhaas, J. M. (2007). *A new animal welfare concept based on allostasis*. *Physiology & Behavior*, 92:422{428.
21. Mendl, M. (1999). *Performing under pressure: Stress and cognitive function*. Applied Animal Behaviour Science, 65(3):221{244.