

The Feeding Behaviour Habits of Growing-Finishing Pigs

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Feed cost represents approximately 65% of the cost production of a pig kg deadweight. Therefore, the search for strategies to improve the utilisation rate of nutrients during the growing-finishing period is of permanent interest. One of the important factors influencing the performance and carcass quality of growing-finishing pigs is feeding behaviour habits (FBHs), which can be described not only by average daily feed intake (ADFI), but also by other criteria such as the daily number of feeder visits, the daily time spent eating, the feed consumed per feeder visit or the rhythm of ingesta, among others. These can be registered and calculated thanks to the availability in the market of automatic feeding systems.

Keywords: feeding behaviour habits ; Growing-finishing pigs ; review

1. Internal Factors That Influence Feeding Behaviour Habits of Growing-Finishing Pigs

1.1. Age

A summary of the effect of age on the FBHs of growing-finishing pigs is shown in **Table 1**. As pigs grow, the ADFI increases; however, the magnitude of the ADFI increase is variable among studies. Labroue et al. ^[1] and Andretta et al. ^[2] reported an increase in the ADFI of around 60% in pigs of similar BW, from 35 to 95–100 kg BW and from 30 to 100 kg BW, respectively; whereas Carcò et al. ^[3] reported a smaller quadratic increase in the ADFI in pigs from 47 to 145 kg BW and Hyun et al. ^[4] obtained an increase in the ADFI of 23% in pigs from 27 to 82 kg BW. On the other hand, pigs eat their ADFI from frequent feeder visits in weaned pigs to few and larger feeder visits in sows together with an increase in the FR ^{[5][6]}. The changes in the TV and VS may be due to larger stomach size as pigs grow. In fact, stomach size increases from 30 mL to 3.5 L from birth to a finishing pig ^[7]. Therefore, it can be hypothesized that 20 kg BW pigs ingesta could be limited by their stomach capacity and as a consequence, carry out a higher number of small feeder visits to achieve the desired ADFI. For instance, as growing-finishing pigs grow, ADFI, VS, MS, and FR increase, whereas small variations or even decreases in the TV, TM, and TD have been reported ^{[1][2][3][4][8]}. However, a large variability in the percentage of increase or decrease in all FBHs exists between studies. In terms of TV or TM, Labroue et al. ^[1] reported an increase in TV of 28% in pigs from 40 to 60 kg BW and a reduction of 11% in pigs from 60 to 90 kg BW; whereas Hyun et al. ^[4] and Gonyou and Lou ^[9] obtained a reduction of 17% in the TM and of 24% in the TV, respectively, in pigs of similar BW. In addition, Andretta et al. ^[2] and Carcò et al. ^[3] reported small variations in terms of TM and TV as pigs grew, respectively. On the other hand, reductions from five to 45% in the TD ^{[1][2][4][8]} and increases from 45 to 123% in the VS or MS ^{[1][2][4]} together with increases from 22 to 133% in the FR as pigs grow have been reported ^{[1][2][4][8]}.

Table 1. Effect of age on the feeding behaviour habits of growing-finishing pigs.

| Reference | Initial and Final BW, kg | ADFI (kg of Feed/d) ¹ | TV (Feeder Visits/d) ² | TM (Meals/Day) ³ | TD (Minutes Spent Eating/d) ⁴ | VS (Feed Consumed/Feeder Visit) ⁵ | MS (Feed Consumed/Meal) ⁶ | FR (Feed Consumed/min) ⁷ |
|-------------------|--------------------------|-------------------------------------|--|---------------------------------|--|--|--------------------------------------|---------------------------------------|
| ^[1] ** | 35 to 95–100 kg | 1.75 to 2.81 (increased by 60%) | From 40 to 60 kg: from 14 to 18 (increased by 28%) From 60 to 90 kg: from 18 to 16 (reduced by 11%) | | From 63.7 to 49.6 (reduced by 22%) | | From 278 to 621 (increased by 123%) | From 28.6 to 58.8 (increased by 106%) |
| | | | | | | | | |
| ^[4] | 27 to 82 kg | 1.55 to 1.9 kg/d (increased by 23%) | | From 7.25 to 6 (reduced by 17%) | From 109 to 60 (reduced by 45%) | | From 220 to 320 (increased by 45%) | From 15 to 35 (increased by 133%) |

| Reference | Initial and Final BW, kg | ADFI (kg of Feed/d) ¹ | TV (Feeder Visits/d) ² | TM (Meals/Day) ³ | TD (Minutes Spent Eating/d) ⁴ | VS (Feed Consumed/Feeder Visit) ⁵ | MS (Feed Consumed/Meal) ⁶ | FR (Feed Consumed/min) ⁷ |
|-----------|--------------------------|----------------------------------|--|--------------------------------------|---|--|---------------------------------------|--|
| [8] | 40 vs. 80 kg | - | 40 kg BW: 55.6 80 kg BW: 42.2 (reduced by 24%) | | 40 kg BW: 102 80 kg BW: 85.6 (reduced by 16%) | - | - | 40 kg BW: 35.6 80 kg BW: 43.5 (increased by 22%) |
| [2] | 30 to 100 kg | 2.13 to 3.4 (increase by 60%) | | From 11 to 11.3 (increased by 3%) | From 68.3 to 65.1 (reduced by 5%) | | From 194 to 301 (increased by 55%) | From 31.4 to 50.2 (increased by 60%) |
| [3] | 47 to 145 kg | Increased | Small variations | | Reduced | Increased | | Increased |

¹ ADFI (average daily feed intake). ² TV (number of feeder visits per pig and day). ³ TM (number of meals per pig and day according to each paper methodology; where a meal is the successive feeder visits within two minutes ^[1]; the successive visits within 28.3 min intervals ^[4]; and the successive feeder visits within one minute ^[2]). Gonyou and Lou, ^[8] reported the number of entrances into the feeder. ⁴ TD (total minutes spent eating per pig and day). ⁵ VS (feed consumed per feeder visit). ⁶ MS (feed consumed per meal). ⁷ FR (feed intake per minute spent eating). ** Predicted values from a model.

1.2. Sex

The contradictory results regarding the effect of sex on the FBHs shown in several studies could be due to the different level of competition access to the feeder ^{[1][2][4][9][10][11][12][13]}. No differences between sex in terms of the FBHs of growing-finishing pigs were found in the meta-analysis of Averós et al. ^[9]. Similarly, Hyun et al. ^[4] only found differences between sexes in terms of TM, being higher for castrated males than for entire males and females; whereas Andretta et al. ^[2] reported no differences in terms of TM between castrated males and females. On the other hand, Cross et al. ^[10] observed that females spent an average of 6.2 min per day less in the feeder than castrated males, a result in line with the findings of Brown-Brandl et al. ^[13]. Moreover, Pichler et al. ^[11] observed bigger and longer meals for growing-finishing entire males than for females with no other FBHs showing differences between sex. In contrast, Young and Lawrence ^[12] observed a tendency for smaller and shorter feeder visits in entire males than females. In addition, Andretta et al. ^[2] reported a 19.23% smaller MS for females compared to castrated males. Furthermore, Labroue et al. ^[1] reported lower MS, ADFI, and TD in entire males than in castrated males with no significant differences in terms of TM, TV, and FR between both groups. Furthermore, Andretta et al. ^[2] indicated that females had a 6.6% lower FR than castrated males (39.9 vs. 42.7 g/min, females and castrated males, respectively).

1.3. Breed

Breed modifies the FBHs of growing-finishing pigs ^{[14][15][16][17]}. Fernández et al. ^[14] classified Large White and Pietrain pigs as nibbler pigs due to more frequent and smaller feeder visits per day than Duroc and Landrace pigs. These results are in keeping with the findings of Labroue et al. ^[15], who reported more frequent smaller feeder visits for Large White than for Landrace pigs. Likewise, Baumung et al. ^[16] observed that Large White pigs ate their ADFI in more TV, with less TD and lower FR, whereas Landrace pigs tended to eat their ADFI in fewer and larger feeder visits. In addition, Quiniou et al. ^[17] concluded that Pietrain pigs could be characterised by eating their ADFI in more frequent, smaller meals than Meishan pigs, with Large White pigs in an intermediate position. On the other hand, Landrace and Large White pigs were classified as fast eater pigs due to the fact that they spent less TD with higher FR than Duroc and Pietrain pigs ^[14]. In agreement with those results, Labroue et al. ^[15] reported smaller differences in terms of FR with an average of 39.9 g/min for Large White and 41.5 g/min for Landrace pigs. In fact, Fernández et al. ^[14] suggested that each breed could be described as follows: Duroc pigs as meal and slow eaters, Landrace pigs as meal and fast eaters, Large White pigs as nibblers and fast eaters, and Pietrain pigs as nibblers and slow eaters.

Despite the inconsistencies among studies of the impact of age, sex, and breed on the FBHs, all of them indicate that the three factors influence FBH. Although different intervals of BW were evaluated in the cited studies, it was found that as pigs grow, ADFI, MS, and FR increase, while decreases or small variations in TD, TV, and TM occur. The results concerning the sex effect on FBHs are confusing, suggesting that the external conditions such as housing conditions or internal factors such as age or breed used could modify FBHs. In fact, most of the authors observed different FBHs when comparing different breeds. Therefore, when comparing the FBH results of different scientific data sources, these factors must be considered.

2. External Factors That Influence Feeding Behaviour Habits of Growing-Finishing Pigs

2.1. Group Size and Feeder Space Allowance

The EU Directive 2008/120/EC [19] determines the minimum stocking density for growing-finishing pigs at different BWs, which is an important factor, as it is demonstrated that it affects the stress levels of growing-finishing pigs [19]. In addition, later studies have observed that increasing group size in growing-finishing pigs in an adequate pen floor space and feeder ratio does not impact their welfare and growth performance [20]. These results suggest that an important factor is feeder access competency. In fact, it has been observed that individually housed pigs eat their ADFI in smaller, more frequent meals, spending more TD on account of a lower FR than group-housed pigs [21][22]. Moreover, when increasing the group size from two to 12 growing pigs per pen (from 27 to 48 kg BW) with the same stocking density of 0.9 m²/pig and with a single-space feeder, pigs reduced the TD and increased the FR with lower ADFI and ADG with no effect on the feed conversion ratio (FCR) [23]. When increasing the group size from five to 20 pigs per pen in 34 kg BW pigs for 29 days keeping the same stocking density of 1.06 m²/pig with a single-space feeder, pigs ate their DFI in fewer and larger feeder visits with higher FR with no impact on performance results (no differences in ADFI, ADG, and FCR) [24]. In finishing pigs, the increase from two to 12 pigs in group size increased the TD, MS, and FR and reduced the TV with no effect on ADFI, ADG, or FCR [25]. Therefore, these results suggest that growing-finishing pigs may modify their FBHs due to the feeder-space restricted situation rather than due to the increase in group size. In fact, Averós et al. [9] predicted that pigs fed under feeder space-restricted conditions increase their FR, make shorter feeder visits, and reduce the TD, results in agreement with Gonyou and Brumm [26]. In fact, Nielsen et al. [27] suggested that the FR may be used as an indicator of social constraint. Therefore, not only is pen floor space important, but it is also important to have the correct feeder ratio. In fact, an insufficient ratio of feeders in group-housed growing-finishing pigs may limit the nutritional requirements of the pigs. However, what does an adequate feeder ratio mean? Linear feeder space is defined as “the linear cm of feeder available per pig within a pen” (total feeder length per pen/total pigs per pen). PIC [28] recommends a minimum between 4.7 and 5.0 cm per pig for dry feeders and between 2.9 and 3.1 cm for wet–dry feeders in pigs from 27 kg BW to target BW to minimize feed waste without decreasing the ADFI of pigs. In fact, Smit et al. [29] observed that 3.4 cm of linear feeder space per pig in wet–dry feeders was enough as they obtained the same growth and final BW with lower ADFI than pigs with one more extra feeder, suggesting that the extra feeder allowed pigs to waste feed. Moreover, Morrison et al. [30] compared growing entire males pigs housed in deep-litter (pen of 200 pigs with 1 m²/pig and 8.3 pigs/feeding space) vs. pigs housed in conventional system (pen of 45 pigs with 0.70 m²/pig and 8.5 pigs/feeding space) from 20 to 22 weeks of age and observed that pigs housed in deep-litter spent less TD, with fewer and larger feeder visits, with a lower frequency of social interactions around the feeder compared to pigs in conventional treatment, concluding that the competency between pigs in the conventional system may be responsible for the shorter and more frequent feeder visits and that pigs are able to modify their FBHs in order to maintain performance under limitations in feeder space. In this sense, Rodríguez-Estévez et al. [31] found that free range pigs modified their foraging group size depending on the grazed resource, with 5.0 animals/group when pigs were grazing in an open pasture versus 5.8 when they were eating acorns under an oak crown because they were conditioned by the crown space to avoid competition when foraging, sharing a mean grazing surface to forage acorns of 8.9 m²/pig.

On the other hand, growing-finishing pigs showed two peaks of feed intake throughout the day (one in the morning and another in the afternoon) [21][41][22], which has also been observed in free range finishing pigs grazing natural resources [32]. During these two peaks, which are accentuated under heat stress conditions [10], the competition access to the feeder increases. In fact, increasing the group size from 10 to 30 pigs increased the feeder occupancy rates due to increased feeding activity during the night and at midday [33], whereas increasing group size from 18 to 22 with an extra feeder allowed pigs to eat according to their preferent diurnal pattern instead of eating at other moments of the day [29]. Moreover, the hierarchy within a pen also influences the FBHs with fewer and larger visits for the high-ranking pigs than the low-ranking pigs [34]. Therefore, under feeder space restrictions, the hierarchy may distinctly modify FBH. These results highlight the importance of analysing the FBH at an individual level.

2.2. Automatic Feeding Systems Used to Record Feeding Behaviour Habits

Different types of automatic feeding systems exist in the market to record the FBH of group-housed growing-finishing pigs. In these systems, pigs are individually identified with a data-carrying transponder with a unique code per pig detected by the reader system installed in the trough [35]. Most of the systems record the start and end time, the duration and the amount of feed intake of each feeder visit, and the pig BW can be registered by the installation of a load cell; from these data, the different FBH parameters can be calculated.



Figure 1. IVOG—A station for individual feed intake recording in group housing (Instentec B.V., Marknesse, the Netherlands) used in the studies of De Haer and Merks, ^[21], De Haer et al. ^[36], De Haer and de Vries, ^[37], Georgsson and Svendsen, ^{[38][39]}, Rauw et al. ^[40], and Fernández et al. ^[14].

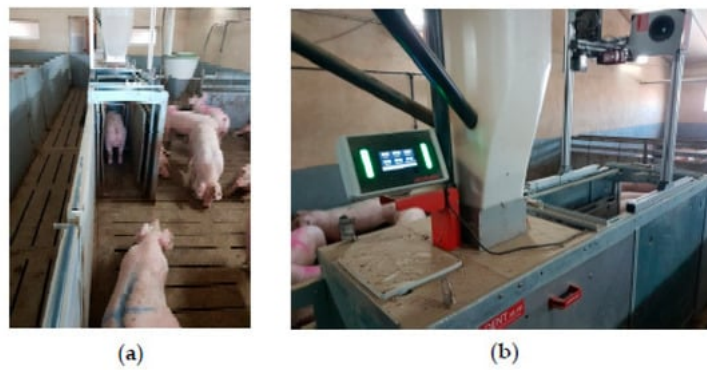


Figure 2. Compident MLP (Schauer Agrotomic GmbH, Austria) used in the study of Garrido-Izard et al. ^[41]. (a) Weighing scale. (b) Feeding station used during the experiment.

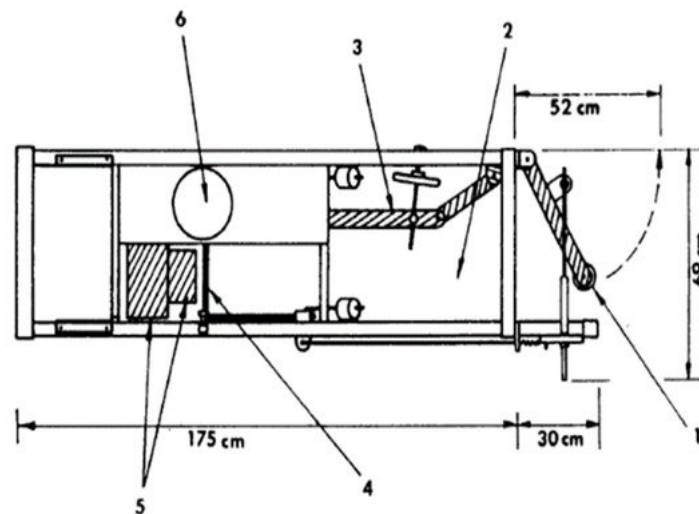


Figure 3. Electronic feeding station referred to as ACEMA "48" used in the study of Labroue et al. ^[1]. (1) Access door to the feeder. (2) Access corridor to the trough. (3) Adjustable side. (4) Trough door. (5) Feed hopper. (6) Mechanism to fill up the trough (Source: ^[1]).

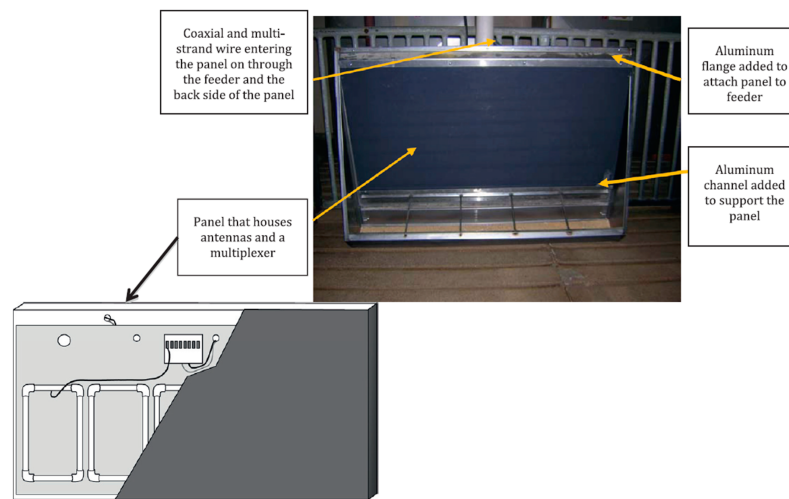


Figure 4. Schema of the panel and a photo of the panel after installation.

One of the available automatic feeding systems is the IVOG-Station (Individual feed intake recording in group housing, Instentec B.V., Marknesse, the Netherlands; **Figure 1**). This system consists of a dry-single space feeder placed on load cells with an adjustable fence that provides head and neck protection for the pig in front of the feeder. This system has been used in the studies of De Haer and Merks, [21], De Haer et al. [36], De Haer and de Vries, [37], Georgsson and Svendsen, [38][39], Rauw et al. [40] and Fernández et al. [14].

Another type of automatic feeding system is the Compident Pig-MLP (Schauer Agrotonic, Austria; **Figure 2**), which can feed growing-finishing pigs ad libitum and ration up to four different feeds at the same time and was used in the study of Carcò et al. [3] with lateral barriers to avoid competition among the pigs during the feeder visit together with a gate placed in front of the trough that permits only one pig inside the feeder. In the study of Garrido-Izard et al. [41], the Compident MLP (Schauer Agrotonic GmbH, Austria) was also used and equipped with an individual animal scale with lateral barriers to determine individual animal weight from 35 to 120 kg BW by measuring the weight of the front and back parts of the pig.

Labroue et al. [1] used a system referred to as “ACEMA 48” (**Figure 3**). This system consists of a trough, which allowed them to weigh the feed and a gate to avoid the entrance of more than one pig into the trough at the same time. Feed is weighed before and after each feeder visit and if the amount of feed after the visit of a pig is below 400 g, the hopper is refilled up to 1200 g.

Hyun et al. [4] used recording equipment (F.I.R.E., Hunday Electronics, Newcastle-upon-Tyne, UK) consisting of a trough connected to a load cell equipped with a full-length protective crate to prevent the entrance of more than one pig at any time. Hyun and Ellis [23][25] used a similar feed intake recording system with a crate in front of the trough (Osborne Industries, Osborne, KS). On the other hand, Brown-Brandl et al. [13] developed a system to record the TD per pig in a commercial trough by a radio frequency identification system in growing-finishing pigs (**Figure 4**).

It is known that the type of automatic feeding system used influences FBH of growing-finishing pigs [39][42]. Therefore, due to the existence or not of lateral barriers to protect the head and neck while the pig is eating, or due to the presence or not of a gate to prevent the access of more than one pig to the feeder, the FBHs differ. In fact, the model of the meta-analysis of Averós et al. [9] predicted that the use of protection barriers within individual feeders increased the TD and reduced the TV, FR, and FCR compared to when using feeders without protection barriers. Moreover, Bruininx et al. [43], comparing weaning pigs allotted in the IVOG feeding station versus pigs allotted in commercial single-space dry feeders for 34 days, obtained higher ADFI during the first 13 days for the pigs reared in the IVOG system, but during the remaining 21 days and overall, the ADG and the FCR did not differ between systems. In growing-finishing pigs, a higher ADFI and poorer FCR were obtained in pigs allotted in IVOG stations compared to conventional feeders [38], whereas similar ADG but lower ADFI and FCR were reported in growing- [23] and finishing pigs [25] fed by electronic feeders compared to those pigs fed by conventional feeders. The reasons for the lower ADFI or improved FCR in pigs fed by electronic feeders compared to conventional feeders may be a consequence of the lower feed waste due to the design of the feeder or because only one pig can access the trough of the automatic feeding systems at any one time, reducing the competency in the feeder if it is compared to conventional feeders.

2.3. Feed Form and Feed Distribution

Growing-finishing pigs can be fed with different feed forms (mash or pelleted feed), with different water level availability in the feeder (dry feeders or wet–dry feeders) and by different feed distribution systems (ad libitum or restricted). MacDonald and Gonyou [44] reported that growing-pigs (35–45 kg BW pigs) and finishing-pigs (90–100 kg BW) spent more time eating when feed was in dry mash than in dry pellet form. On average, pelleted fed pigs spent 11.5% less time eating than mash fed pigs. Those results are in agreement with Li et al. [45], who reported a 23.5% and a 37.1% reduction in the TD in

growing and finishing pigs, respectively, with pigs fed with pellets compared to pigs fed with mash; furthermore, the pigs fed with pelleted feed had a higher FR and a lower feeder occupancy rate. These results are in concordance with Laitat et al. [46], who observed that weaned pigs needed more time to achieve the same ADFI when feeding a mash diet than a pelleted diet due to lower FR.

MacDonald and Gonyou [44] and Li et al. [45] analysed the combined effect of feed form (mash vs. pellet) and water availability (dry vs. wet-dry feeders) in growing-finishing pigs. In both growing (20 to 60 kg BW) and finishing (60 to 100 kg BW) pigs, Li et al. [45] observed an interactive effect of feed form and water availability with the dry-mash fed pigs spending a longer time eating due to their lower FR than any other treatment. These results are consistent with the previous findings of MacDonald and Gonyou [44]. In addition, Gonyou and Lou [8] also observed that growing-finishing pigs fed ad libitum by wet-dry feeders spent 17% less time eating than pigs fed by dry feeders, suggesting that growing-finishing pigs prefer wet-dry to dry feeders [29]; furthermore, pigs fed by wet-dry feeders had higher ADFI and ADG and pigs were less lean. In the study of Li et al. [45], the effect of feed form and water availability on performance was analysed in growing and in finishing pigs. In both phases, water availability did not influence FCR, the most efficient pigs being those fed a pelleted diet. Additionally, FBHs of growing-finishing pigs differed when the same feed was offered: dry or dry feed diluted with water (88.6 vs. 27.8% dry matter, dry and dry-feed diluted, respectively) twice per day; growing-finishing pigs fed with dry feed diluted with water spent around 50% less time than pigs fed with dry feed with no differences in terms of performance [47].

On the other hand, the meta-analysis of Averós et al. [9] reported that pigs fed restrictively ate in longer feeder visits and were more active, perhaps because the pigs visited the feeder to check whether there was feed available, than pigs fed ad libitum. On extensive farms, in which pigs have access to restricted feed together with ad libitum access to fodder and grass, the feeding behaviour of pigs depends on a large number of factors such as the dietary supplementation, grazing management, and grass quality, among others [48].

2.4. Diet Composition

Several studies have evaluated the effect of diet composition on the FBHs of growing-finishing pigs. The main factor that modifies the ADFI of a pig is the energy content of the diet; a pig fed with a low energy diet eats more feed per day compared to a pig fed with a high energy diet in order to achieve the required daily energy [29]. In fact, the dilution of the energy concentration of the diet can be carried out by increasing the dietary fibre level, which may be used as a strategy to reduce stereotypic behaviour and to enhance welfare by its satiety effect after a meal by reducing feed motivation [49] [50]. In fact, pigs fed with a low nutrient density spent longer eating per day and per feeder visit compared to pigs fed with a higher nutrient density diet [11]. In addition, Quemeneur et al. [51] concluded that the inclusion of fibre (a mix of wheat, soy, and sugar beet pulp fibres) decreased meal frequency, increased MS, whereas the supplementation of aleurone decreased the TM with no effect on MS. On the other hand, lysine content in the diet reduced the number and increased the length and size of feeder visits [4]. Carcò et al. [52] observed that pigs increased ADFI and tended to increase the FR with reduced amino acid content in the diet to achieve nutritional requirements. Furthermore, the flavour and the palatability of feed may stimulate the appetite of pigs. In fact, the inclusion of flavouring additives such as dextrose increases the ADFI of pigs, although there are discrepancies about this fact in the literature [53]. On the other hand, Iberian finishing pigs under extensive conditions depending on natural resources without compound feed remain active, foraging acorns and grass an average of 369 min per day, which is approximately 60% of winter daylight hours; this kind of slow eating would be very dependent on the natural diet [54].

2.5. Environmental Conditions

The effect of high temperature on ADFI, pig activity, and performance has been widely studied [9][55][56][57]. The meta-analysis of Renaudeau et al. [59] shows that the reduction in ADFI and ADG under high temperature is higher in heavier than in lighter growing-finishing pigs (**Figure 5**).

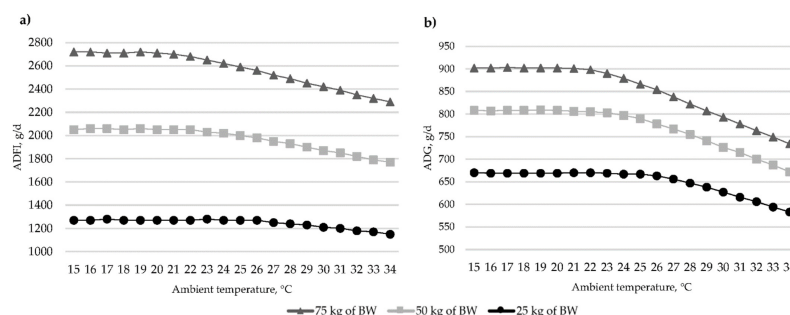


Figure 5. The effects of ambient temperature and pig BW on (a) ADFI and (b) ADG.

However, few studies have evaluated the effect of environmental conditions on the FBHs of growing-finishing pigs (**Table 2**). In growing pigs (from 21 to 30 kg BW), Collin et al. [59] reported a reduction of 30% in ADFI, 32% in MS, and 27% in TD with a negative impact on BW gain (−37%) after thirteen consecutive days at 33 °C compared to the control group reared

at 23 °C. In heavier pigs (62 kg BW), a decrease of 24% in ADFI, 21% in TV, and 28% in TD were observed when the temperature was increased from 19 to 29 °C for three or four consecutive days at 19, 22, 25, 27, or 29 °C [55]. In fact, Cross et al. [10] observed a reduction of approximately four minutes in TD when growing-finishing pigs were under heat stress conditions. The reduction in ADFI under heat stress is probably a strategy to reduce body heat production [60], which comes from maintenance, physical activity, and feed intake [56].

Table 2. The effect of environmental conditions on the feeding behaviour habits of growing-finishing pigs.

| Reference | Environmental Challenge | BW (kg) | Breed ¹ | Density (m ² /pig) | Floor Type | I/GH ² | ADFI (kg of Feed/d) ³ | TV (Feeder Visits/d) or TM (Meals/d) ⁴ | TD (Minutes Spent Eating/d) ⁵ | MS (Feed Consumed/Meal) ⁶ | FR (Feed Cons |
|-----------|--|---|--------------------|-------------------------------|---------------|-------------------|----------------------------------|---|--|--------------------------------------|---------------|
| [55] | From 19 °C to 29 °C (three–four consecutive days at 19, 22, 25, 27 or 29 °C) | 62 kg | P × LW | 1.2 (3 pigs/pen) | Metal slatted | GH | Reduced by 24% * | Reduced by 21% ** | Reduced by 28% *** | Reduced by 17% | |
| [59] | 13 days at 33 °C vs. at 23 °C | From 21 kg to 30 kg BW | (LW × L) × P | 0.73 (5 pigs/pen) | Metal slatted | GH | Reduced by 30% ** | Reduced by 30% | Reduced by 27% ** | Reduced by 32% * | |
| [10] | Ambient temperatures from May 2014 to April 2016 | Four groups (n = 240) 4-month grow-out period | D, L and Y | 0.80 (40 pigs/pen) | - | GH | - | Reduced in L pigs | 4 min/d less at emergency THI level | - | |

¹ Duroc (D), Landrace (L), Large White (LW), Pietrain (P), Yorkshire (Y). ² Individual (I) or Group Housing (GH). ³ ADFI (average daily feed intake). ⁴ Quiniou et al. [55] and Collin et al. [59] analysed the number of meals per pig and day; according to their paper methodology; where a meal is: the successive feeder visits by the same pig within two minutes. Cross et al. [10] reported the number of feeder visits per pig and day (TV). ⁵ TD (total minutes spent eating per pig and day). ⁶ MS (feed consumed per meal: according to each paper's methodology). ⁷ FR (feed intake per minute spent eating). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Moreover, the feed intake schedule changes under different environmental conditions. Under hot conditions, pigs reduce their physical activity [56] and spend more time lying and less time eating [61]. Cross et al. [10] observed that under thermoneutral conditions, most feeder activities were carried out from 6:00 to 17:59 h, while when pigs were suffering heat stress, a peak feeding activity occurred between 6:00 and 08:59 h, a reduction during midday, and another peak of feeder activity between 18:00 and 20:59 h in all breeds and genders studied.

The mentioned scientific data regarding the effect of external factors on the FBHs of growing-finishing pigs highlights the importance of the knowledge of each of the factors explored as all of them impact on the FBHs. In intensive conditions, pigs are allotted in groups in pens that can differ in terms of size, number, and type of feeders or stocking density, among others. The mentioned data indicate that growing-finishing pigs are able to adapt their FBHs to achieve the desired ADFI to maintain growth. Therefore, depending on housing conditions, pigs change their FBHs. On the other hand, feed form and feed distribution influence the FBHs; pigs fed in dry mash spend more time eating than pigs fed in dry pelleted feed due to lower FR, whereas when water is available in the feeder, their ADFI and FR increase, but with no influence on FCR. These results indicate that the feeder occupancy rates are higher when pigs are fed in mash, suggesting that the stocking density recommended could depend on the feed form offered. Continuing with parameters related with diet, its composition is of high importance. It is widely known that ADFI depends mainly on diet energy density, with a higher ADFI in pigs fed with low-density diets than pigs fed with high-density diets. However, the type of fibre used or the amino acid content can also modify the FBHs of growing-finishing pigs. Finally, the magnitude of the impact of environmental conditions on ADFI was higher in older than in younger pigs, also distinctly affecting the FBHs depending on the age.

References

1. Labroue, F.; Guéblez, R.; Sellier, P.; Meunier-Salaün, M.C. Feeding-behavior of group-housed Large White and Landrace pigs in French central test stations. *Livest. Prod. Sci.* 1994, 40, 303–312.
2. Andretta, I.; Pomar, C.; Kipper, M.; Hauschild, L.; Rivest, J. Feeding behavior of growing-finishing pigs reared under precision feeding strategies. *J. Anim. Sci.* 2016, 94, 3042–3050.

3. Carcò, G.; Gallo, L.; Dalla Bona, M.; Latorre, M.A.; Fondevila, M.; Schiavon, S. The influence of feeding behaviour on growth performance, carcass and meat characteristics of growing pigs. *PLoS ONE* 2018, 13, 15.
4. Hyun, Y.; Ellis, M.; McKeith, F.K.; Wilson, E.R. Feed intake pattern of group-housed growing-finishing pigs monitored using a computerized feed intake recording system. *J. Anim. Sci.* 1997, 75, 1443–1451.
5. Bigelow, J.A.; Houpt, T.R. Feeding and drinking patterns in young pigs. *Physiol. Behav.* 1988, 43, 99–109.
6. Auffray, P.; Marcilloux, J.C. Analysis of porcine feeding patterns from weaning to adulthood. *Reprod. Nutr. Dev.* 1980, 20, 1625–1632.
7. Lærke, H.N.; Hedemann, M.S. The Digestive System of The Pig (Chapter 5). In *Nutritional Physiology of Pigs*—Online Publication; Videcenter for Svineproduktion: Foulum, Denmark, 2012.
8. Gonyou, H.W.; Lou, Z. Effects of eating space and availability of water in feeders on productivity and eating behavior of grower/finisher pigs. *J. Anim. Sci.* 2000, 78, 865–870.
9. Averós, X.; Brossard, L.; Dourmad, J.Y.; de Greef, K.H.; Edwards, S.A.; Meunier-Salaün, M.C. Meta-analysis on the effects of the physical environment, animal traits, feeder and feed characteristics on the feeding behaviour and performance of growing-finishing pigs. *Animal* 2012, 6, 1275–1289.
10. Cross, A.J.; Brown-Brandl, T.M.; Keel, B.N.; Cassady, J.P.; Rohrer, G.A. Feeding behavior of grow-finish swine and the impacts of heat stress. *Transl. Anim. Sci.* 2020, 4, 986–992.
11. Pichler, J.; Schwarz, C.; Gierus, M.; Schedle, K. Choice feeding in fattening pigs: Effect of diets differing in nutrient density on feeding behaviour and fattening performance. *Czech J. Anim. Sci.* 2020, 65, 247–257.
12. Young, R.J.; Lawrence, A.B. Feeding behaviour of pigs in groups monitored by a computerized feeding system. *Anim. Prod.* 1994, 58, 145–152.
13. Brown-Brandl, T.M.; Rohrer, G.A.; Eigenberg, R.A. Analysis of feeding behavior of group housed growing-finishing pigs. *Comput. Electron. Agric.* 2013, 96, 246–252.
14. Fernández, J.; Fàbrega, E.; Soler, J.; Tibau, J.; Ruiz, J.L.; Puigvert, X.; Manteca, X. Feeding strategy in group-housed growing pigs of four different breeds. *Appl. Anim. Behav. Sci.* 2011, 134, 109–120.
15. Labroue, F.; Guéblez, R.; Sellier, P. Genetic parameters of feeding behaviour and performance traits in group-housed Large White and French Landrace growing pigs. *Genet. Sel. Evol.* 1997, 29, 451–468.
16. Baumung, R.; Lercher, G.; Willam, A.; Sölkner, J. Feed intake behaviour of different pig breeds during performance testing on station. *Arch. Tierz.* 2006, 49, 77–88.
17. Quiniou, N.; Dubois, S.; Le Cozler, Y.; Bernier, J.F.; Noblet, J. Effect of growth potential (body weight and breed/castration combination) on the feeding behaviour of individually kept growing pigs. *Livest. Prod. Sci.* 1999, 61, 13–22.
18. The European Commission. Commission Recommendation (EU) 2016/336 of 8 March 2016 on the Application of Council Directive 2008/120/EC Laying down Minimum Standards for the Protection of Pigs as Regards Measures to Reduce the Need for Tail-Docking. *Off. J. Eur. Union* 2016. Available online: <https://eur-lex.europa.eu/eli/reco/2016/336/oj> (accessed on 16 April 2019).
19. Cornale, P.; Macchi, E.; Miretti, S.; Renna, M.; Lussiana, C.; Perona, G.; Mimosi, A. Effects of stocking density and environmental enrichment on behavior and fecal corticosteroid levels of pigs under commercial farm conditions. *J. Vet. Behav.* 2015, 10, 569–576.
20. Schmolke, S.A.; Li, Y.Z.; Gonyou, H.W. Effect of group size on performance of growing-finishing pigs. *J. Anim. Sci.* 2003, 81, 874–878.
21. De Haer, L.C.M.; Merks, J.W.M. Patterns of daily food-intake in growing pigs. *Anim. Prod.* 1992, 54, 95–104.
22. Bornett, H.L.I.; Morgan, C.A.; Lawrence, A.B.; Mann, J. The effect of group housing on feeding patterns and social behaviour of previously individually housed growing pigs. *Appl. Anim. Behav. Sci.* 2000, 70, 127–141.
23. Hyun, Y.; Ellis, M. Effect of group size and feeder type on growth performance and feeding patterns in growing pigs. *J. Anim. Sci.* 2001, 79, 803–810.
24. Nielsen, B.L.; Lawrence, A.B.; Whittemore, C.T. Effect of group-size on feeding behaviour, social behaviour, and performance of growing pigs using single-space feeders. *Livest. Prod. Sci.* 1995, 44, 73–85.
25. Hyun, Y.; Ellis, M. Effect of group size and feeder type on growth performance and feeding patterns in finishing pigs. *J. Anim. Sci.* 2002, 80, 568–574.
26. Gonyou, H.W.; Brumm, M.C. *Swine Nutrition*, 2nd ed.; Lewis, A.J., Southern, L.L., Eds.; CRC Press: Boca Raton, FL, USA, 2001; pp. 499–518.
27. Nielsen, B.L. On the interpretation of feeding behaviour measures and the use of feeding rate as an indicator of social constraint. *Appl. Anim. Behav. Sci.* 1999, 63, 79–91.
28. PIC. Wean to Finish Guidelines. PIC. Available online: <https://afly.co/zlh6> (accessed on 31 January 2022).
29. Smit, M.N.; Zhou, X.; Landero, J.L.; Young, M.G.; Beltranena, E. Dietary energy level, feeder space, and group size on growth performance and carcass characteristics of growing-finishing barrows and gilts. *Transl. Anim. Sci.* 2021, 5, 15.

30. Morrison, R.S.; Hemsworth, P.H.; Cronin, G.M.; Campbell, R.G. The social and feeding behaviour of growing pigs in deep-litter, large group housing systems. *Appl. Anim. Behav. Sci.* 2003, 82, 173–188.
31. Rodríguez-Estévez, V.; Sánchez-Rodríguez, M.; Gómez-Castro, A.G.; Edwards, S.A. Group sizes and resting locations of free range pigs when grazing in a natural environment. *Appl. Anim. Behav. Sci.* 2010, 127, 28–36.
32. Rodríguez-Estévez, V.; García, A.; Peña, F.; Gómez, A.G. Foraging of Iberian fattening pigs grazing natural pasture in the dehesa. *Livest. Sci.* 2009, 120, 135–143.
33. Walker, N. The effects on performance and behavior of number of growing pigs per mono-place feeder. *Anim. Feed. Sci. Technol.* 1991, 35, 3–13.
34. Hoy, S.; Schamun, S.; Weirich, C. Investigations on feed intake and social behaviour of fattening pigs fed at an electronic feeding station. *Appl. Anim. Behav. Sci.* 2012, 139, 58–64.
35. Maselyne, J.; Van Nuffel, A.; De Ketelaere, B.; Vangeyte, J.; Hessel, E.F.; Sonck, B.; Saeys, W. Range measurements of a High Frequency Radio Frequency Identification (HF RFID) system for registering feeding patterns of growing-finishing pigs. *Comput. Electron. Agric.* 2014, 108, 209–220.
36. De Haer, L.C.M.; Luiting, P.; Aarts, H.L.M. Relations among individual (residual) feed-intake, growth-performance and feed-intake pattern of growing pigs in-group housing. *Livest. Prod. Sci.* 1993, 36, 233–253.
37. De Haer, L.C.M.; De Vries, A.G. Feed-intake patterns of and feed digestibility in growing pigs housed individually or in groups. *Livest. Prod. Sci.* 1993, 33, 277–292.
38. Georgsson, L.; Svendsen, J. One or two feeders for groups of 16 growing-finishing pigs: Effects on health and production. *Acta Agric. Scand. A. Anim. Sci.* 2001, 51, 257–264.
39. Georgsson, L.; Svendsen, J. Degree of competition at feeding differentially affects behavior and performance of group-housed growing-finishing pigs of different relative weights. *J. Anim. Sci.* 2002, 80, 376–383.
40. Rauw, W.M.; Soler, J.; Tibau, J.; Reixach, J.; Raya, L.G. Feeding time and feeding rate and its relationship with feed intake, feed efficiency, growth rate, and rate of fat deposition in growing Duroc barrows. *J. Anim. Sci.* 2006, 84, 3404–3409.
41. Garrido-Izard, M.; Correa, E.C.; Requejo, J.M.; Diezma, B. Continuous Monitoring of Pigs in Fattening Using a Multi-Sensor System: Behavior Patterns. *Animals* 2020, 10, 52.
42. Maselyne, J.; Saeys, W.; Van Nuffel, A. Review: Quantifying animal feeding behaviour with a focus on pigs. *Physiol. Behav.* 2015, 138, 37–51.
43. Bruininx, E.; van der Peet-Schwering, C.M.C.; Schrama, J.W.; den Hartog, L.A.; Everts, H.; Beynen, A.C. The IVOG feeding station: A tool for monitoring the individual feed intake of group-housed weanling pigs. *J. Anim. Physiol. Anim. Nutr.* 2001, 85, 81–87.
44. MacDonald, K.A.M.; Gonyou, H.W. Effect of feed presentation on the feeding behaviour of grower/finisher pigs. Annual Research Report; Prairie Swine Centre Inc.: Saskatoon, SK, Canada, 2000; pp. 25–26.
45. Li, Y.Z.Z.; McDonald, K.A.; Gonyou, H.W. Determining feeder space allowance across feed forms and water availability in the feeder for growing-finishing pigs. *J. Swine Health Prod.* 2017, 25, 174–182.
46. Laitat, M.; Vandenheede, M.; Désiron, A.; Canart, B.; Nicks, B. Influence of diet form (pellets or meal) on the optimal number of weaned pigs per feeding space. *J. Swine Health Prod.* 2004, 12, 288–295.
47. Zoric, M.; Johansson, S.E.; Wallgren, P. Behaviour of fattening pigs fed with liquid feed and dry feed. *Porc. Health Manag.* 2015, 1, 8.
48. Rivero, M.J.; Rodríguez-Estévez, V.; Pietrosoli, S.; Carballo, C.; Cooke, A.S.; Kongsted, A.G. Forage Consumption and Its Effects on the Performance of Growing Swine—Discussed in Relation to European Wild Boar (*Sus scrofa* L.) in Semi-Extensive Systems: A Review. *Animals* 2019, 9, 457.
49. de Leeuw, J.A.; Bolhuis, J.E.; Bosch, G.; Gerrits, W.J.J. Effects of dietary fibre on behaviour and satiety in pigs. *Proc. Nutr. Soc.* 2008, 67, 334–342.
50. Kallabis, K.E.; Kaufmann, O. Effect of a high-fibre diet on the feeding behaviour of fattening pigs. *Archiv. Tierzucht* 2012, 55, 272–284.
51. Quemeneur, K.; Montagne, L.; Le Gall, M.; Lechevestrier, Y.; Labussiere, E. Relation between feeding behaviour and energy metabolism in pigs fed diets enriched in dietary fibre and wheat aleurone. *Animal* 2020, 14, 508–519.
52. Carcò, G.; Dalla Bona, M.; Carraro, L.; Latorre, M.A.; Fondevila, M.; Gallo, L.; Schiavon, S. Influence of mild feed restriction and mild reduction in dietary amino acid content on feeding behaviour of group-housed growing pigs. *Appl. Anim. Behav. Sci.* 2018, 198, 27–35.
53. Nyachoti, C.M.; Zijlstra, R.T.; de Lange, C.F.M.; Patience, J.F. Voluntary feed intake in growing-finishing pigs: A review of the main determining factors and potential approaches for accurate predictions. *Can. J. Anim. Sci.* 2004, 84, 549–566.
54. Rodríguez-Estévez, V.; Sánchez-Rodríguez, M.; García, A.; Gómez-Castro, A.G. Feed conversion rate and estimated energy balance of free grazing Iberian pigs. *Livest. Sci.* 2010, 132, 152–156.

55. Quiniou, N.; Dubois, S.; Noblet, J. Voluntary feed intake and feeding behaviour of group-housed growing pigs are affected by ambient temperature and body weight. *Livest. Prod. Sci.* 2000, 63, 245–253.
56. Kerr, B.J.; Yen, J.T.; Nienaber, J.A.; Easter, R.A. Influences of dietary protein level, amino acid supplementation and environmental temperature on performance, body composition, organ weights and total heat production of growing pigs. *J. Anim. Sci.* 2003, 81, 1998–2007.
57. Le Bellego, L.; van Milgen, J.; Noblet, J. Effects of high ambient temperature on protein and lipid deposition and energy utilization in growing pigs. *Anim. Sci.* 2002, 75, 85–96.
58. Renaudeau, D.; Gourdière, J.L.; St-Pierre, N.R. A meta-analysis of the effects of high ambient temperature on growth performance of growing-finishing pigs. *J. Anim. Sci.* 2011, 89, 2220–2230.
59. Collin, A.; van Milgen, J.; Dubois, S.; Noblet, J. Effect of high temperature on feeding behaviour and heat production in group-housed young pigs. *BJN* 2001, 86, 63–70.
60. Cervantes, M.; Antoine, D.; Valle, J.A.; Vásquez, N.; Camacho, R.L.; Bernal, H.; Morales, A. Effect of feed intake level on the body temperature of pigs exposed to heat stress conditions. *J. Therm. Biol.* 2018, 76, 1–7.
61. Brown-Brandl, T.M.; Eigenberg, R.A.; Nienaber, J.A.; Kachman, S.D. Thermoregulatory profile of a newer genetic line of pigs. *Livest. Prod. Sci.* 2001, 71, 253–260.

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