

Deciphering the Impact of Feeding Behavior on Growth Performance and Feed Efficiency in Grower-Finisher Pigs

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 Disclaimer: the PIGWEB project has received funding from European Union's Horizon 2020 research and innovation program under Grant Agreement No 101004770.

Tracking Animal Feeding Behaviour with automatic feeders



Affiche les données d'alimentation

Tout ☒ Détails Recherche 31.01.2023 à 10.02.2023 Nb jours 18

Engraissement ☒ Synthèse

Cochons : 4/75

NoBta	Tierle	Groupe	Sil	Date	Station	Nourriture	Cochon	NoBOTA	Debut	Fin	Quantité	Poids avant	Poids après	secondes
3213-FES	3213	élève		30/01/2023	3	Vpe50 G20	3236	3236-FES	09:03:30	09:04:24	3			54
3214-FES	3214	élève		30/01/2023	3	Vpe50 G20	3236	3236-FES	09:16:38	09:18:38	25			120
3215-FES	3215	élève		30/01/2023	3	Vpe50 G20	3236	3236-FES	09:20:34	09:21:13	9			39
3227-FES	3227	Vpe50		30/01/2023	3	Vpe50 G20	3236	3236-FES	09:26:44	09:27:29	9			41
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3234-FES	3234	élève		30/01/2023	3	Vpe50 G20	3236	3236-FES	09:36:43	09:37:23	13			40
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3236-FES	3236	Vpe50		30/01/2023	3	Vpe50 G20	3236	3236-FES	09:40:37	09:41:24	11			47
3240-FES	3240	Vpe50		30/01/2023	3	Vpe50 G20	3236	3236-FES	10:07:22	10:08:41	24			79
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3287-FES	3287	Vpe50		31/01/2023	3	Vpe50 G20	3236	3236-FES	08:09:05	08:10:26	34			81
3332-FES	3332	élève		31/01/2023	3	Vpe50 G20	3236	3236-FES	08:11:13	08:11:36	11	14		23
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3357-FES	3357	élève		31/01/2023	3	Vpe50 G20	3236	3236-FES	10:39:46	10:42:38	34			172
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11001				31/01/2023	3	Vpe50 G20	3236	3236-FES	13:24:24	13:25:28	26			64
11002				31/01/2023	3	Vpe50 G20	3236	3236-FES	13:29:46	13:31:33	38			107

Effectue la recherche Fermer

Date

Animal ID

Time
entering/exiting
the feeder

Feed eaten

Time spent eating



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Relationship between feed intake and feeding behavior

Average daily feed intake depends on

Daily feeder visits
Feed intake per visit

$$N_V$$

$$g/N_V$$

Daily number of meals
Feed intake per meal

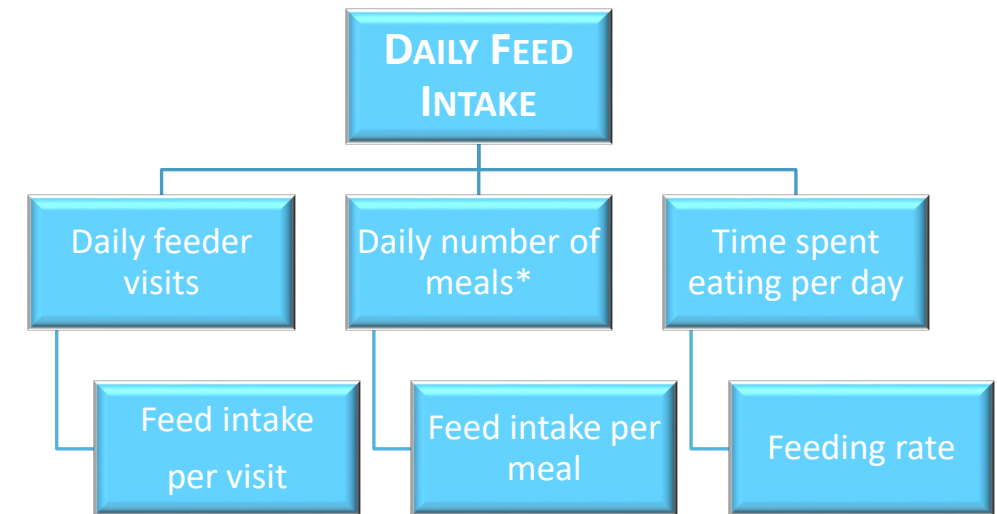
$$N_M$$

$$g/N_M$$

Time spent eating
Feeding rate

$$\text{min}$$

$$g/\text{min}$$



* between-visit intervals shorter than 5 min were regarded as within-meal feeder visits and grouped into meals



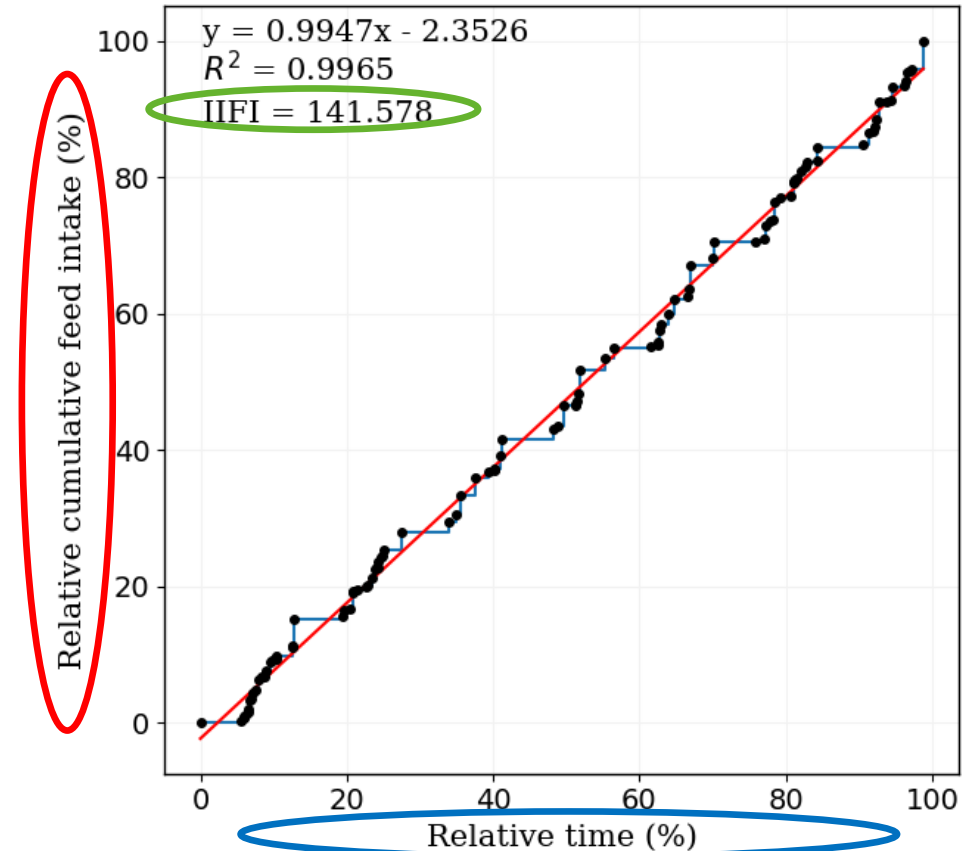
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The index of irregularity of feed intake (IIFI)

according to Salgado et al. (2021)

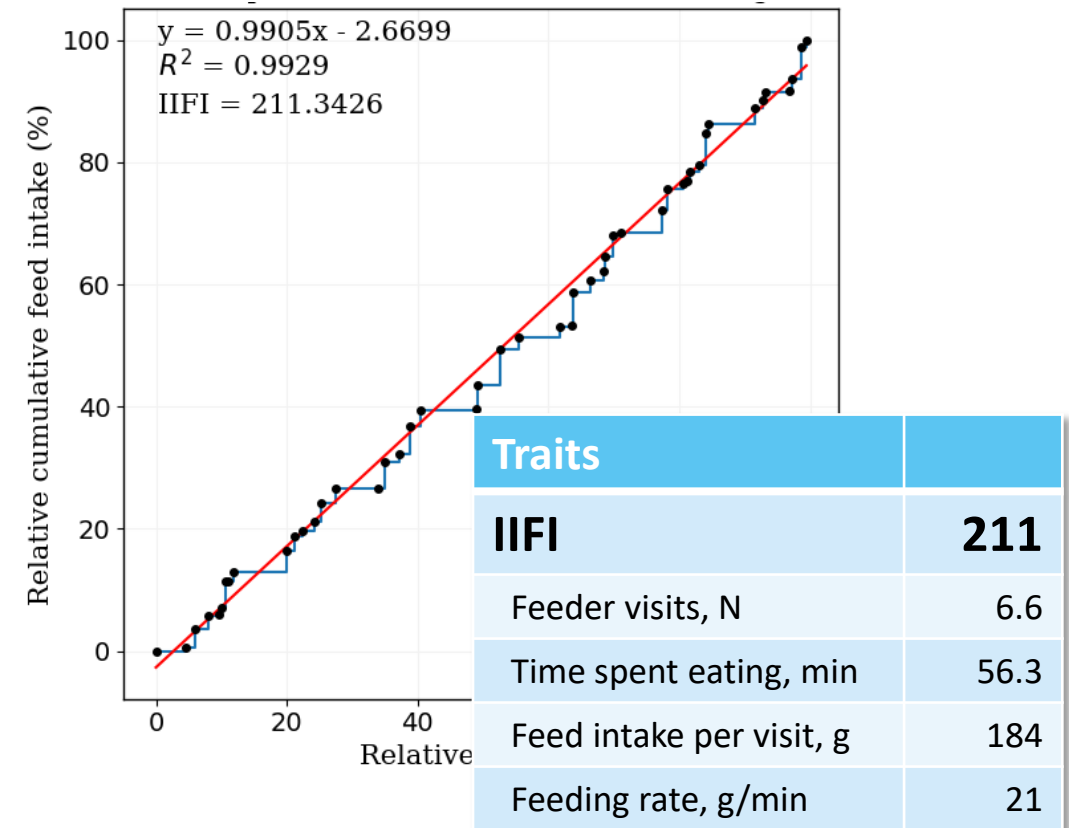
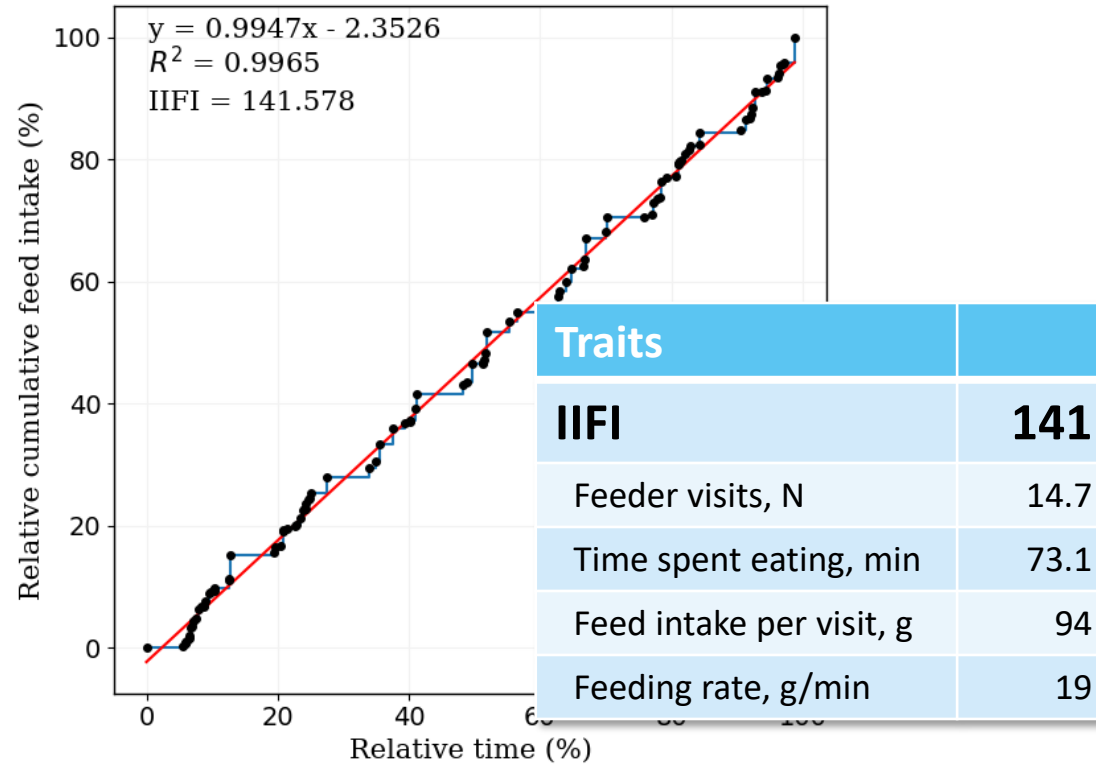
The index is calculated as the relative cumulative feed intake over the relative time and is an increasing step function.

- The relative cumulative feed intake is expressed as the percentage of cumulative feed intake on each visit in relation to the total feed intake over the week.
- The relative time of each visit is expressed as the percentage of total time for a week.
- The distances from the step function in relation to the slope of the linear regression are considered deviation areas. **The sum of these deviation areas gives the IIFI for each pig and week.**



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What can the IIFI tell us?



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Study objectives

1. To analyze how feed intake patterns influence growth performance traits and nutrient efficiency in growing pigs.
2. To explore the potential of feeding pattern as proxies to predict growth rate and feed efficiency.



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Data used for the exploratory data analysis

ANIMALS AND TREATMENTS

- 48 Swiss Large White castrates
- 3 dietary treatments
 - 12 animals per treatments
 - *ad libitum* feeding
- Body weight range: 20 – 110 kg

COLLECTED DATA

- individual feeding data
 - ADFI, feeding behavior traits
- weekly monitoring of BW
 - ADG, FCR



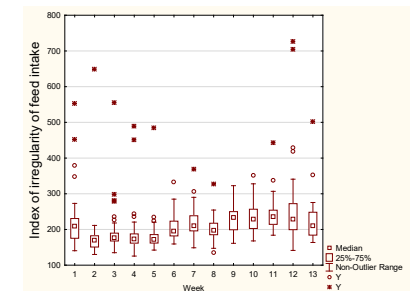
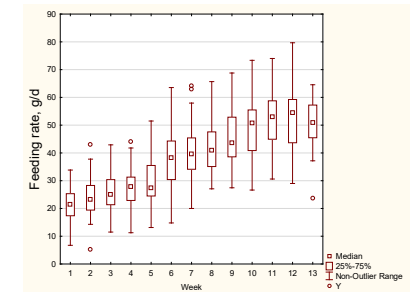
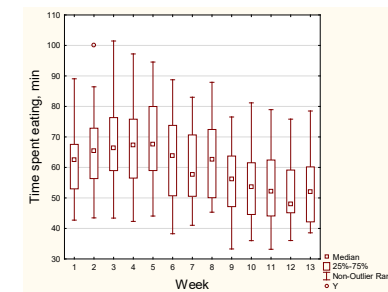
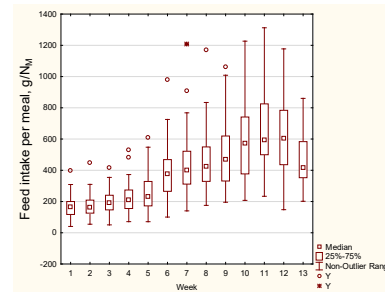
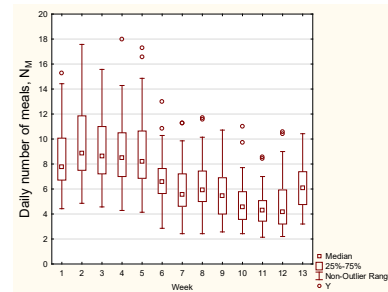
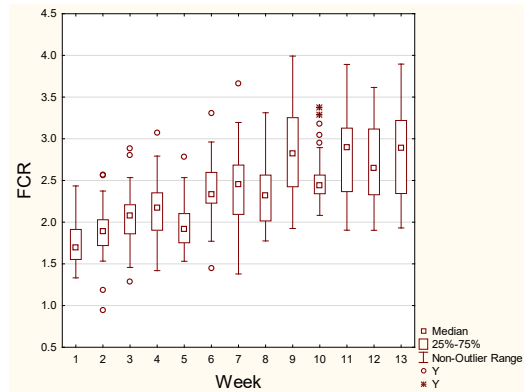
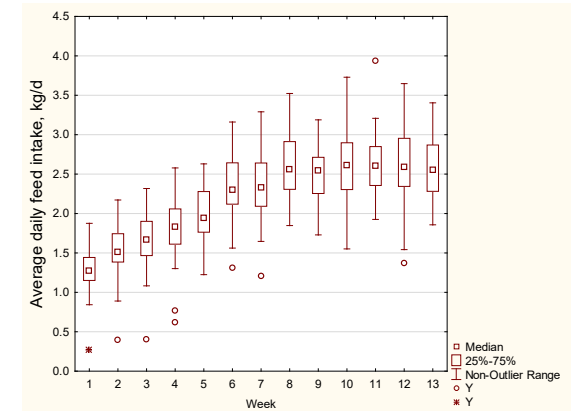
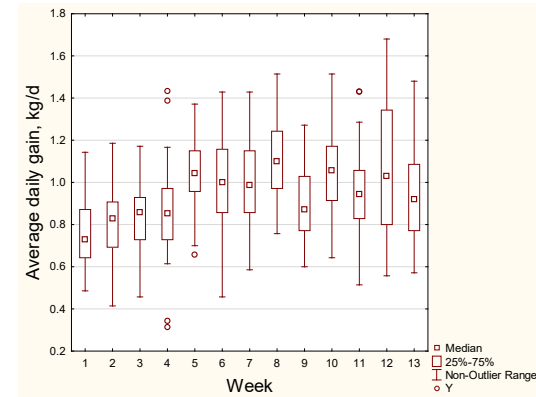
Debut	Fin	Quantité	Poids avant	Poids après	nbsecondes
09:03:30	09:04:24	3			54
09:16:38	09:18:38	25			120
09:20:34	09:21:13	9			39
09:26:44	09:27:25	9			41
09:33:23	09:34:01	4			38
09:36:43	09:37:23	13			40
09:39:12	09:39:27	15			15
09:46:37	09:47:24	11			47
10:07:22	10:08:41	24			79
10:10:37	10:11:05	12			28
10:13:12	10:13:39	9			27
10:20:12	10:20:56	10			44
10:36:17	10:40:02	75			225
11:30:52	11:32:24	32			92
11:33:41	11:34:21	14			40
11:54:16	11:58:47	75			271
13:42:54	13:43:33	109			339
14:15:23	14:15:40	4			17
14:32:27	14:33:53	29			86
17:02:08	17:04:54	74	21		166
17:05:08	17:05:47	13	11		19
17:06:36	17:09:05	62	9		149
17:40:46	17:41:55	165	23		429
17:50:50	17:53:43	44	6		179
18:34:49	18:39:00	86			251
18:50:34	18:51:10	3			36
19:13:31	19:15:14	33	16		103
08:05:54	08:07:50	42			124
08:09:05	08:10:26	34			81
08:11:13	08:11:36	11	14		23
09:37:29	09:43:55	139			386
10:39:46	10:42:38	54			172
10:44:12	10:45:01	15			49
10:54:29	10:57:29	60	26		180
11:02:51	11:03:18	6			27
13:09:02	13:12:23	68			181
13:24:24	13:28:38	26			64
13:29:46	13:31:33	38			107



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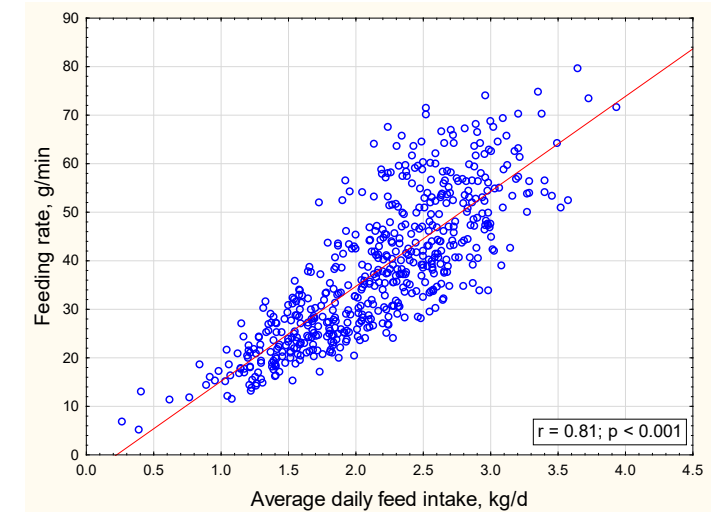
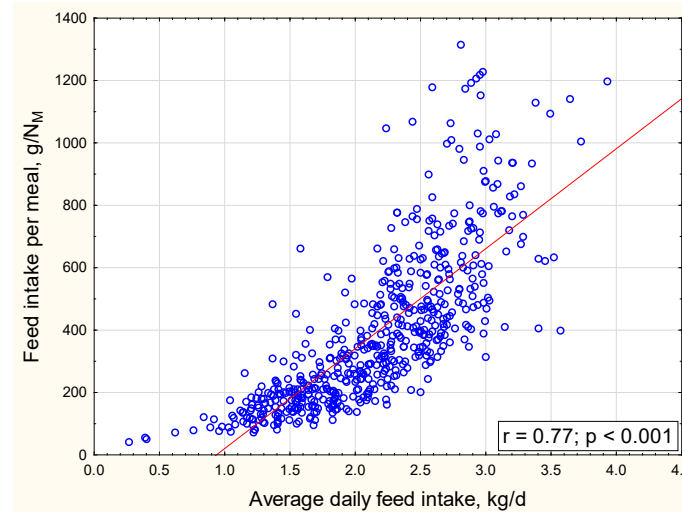
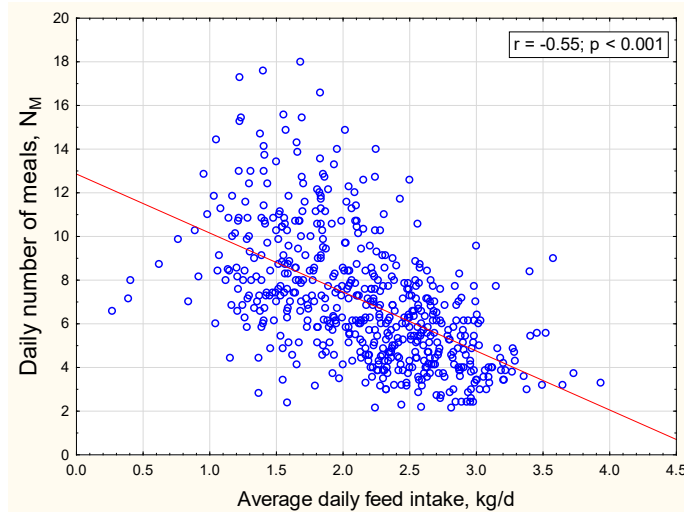
Information about the data set

Traits	Mean	Median	Minimum	Maximum	SE
Body weight, kg	62.42	61.10	16.70	131.80	1.20
Average daily gain, kg/d	0.94	0.93	0.31	1.68	0.01
Average daily feed intake, kg/d	2.17	2.21	0.39	3.93	0.03
FCR	2.33	2.26	0.94	3.99	0.02
Daily number of meals, NM	7.09	6.69	2.14	18.00	0.13
Feed intake per meal, g/NM	388.50	324.97	54.80	1'312.40	10.70
Time spent eating, min	60.90	59.93	33.17	101.45	0.57
Feeding rate, g/min	37.76	35.90	5.18	79.67	0.62
IIFI	208.89	196.73	125.48	648.02	2.38



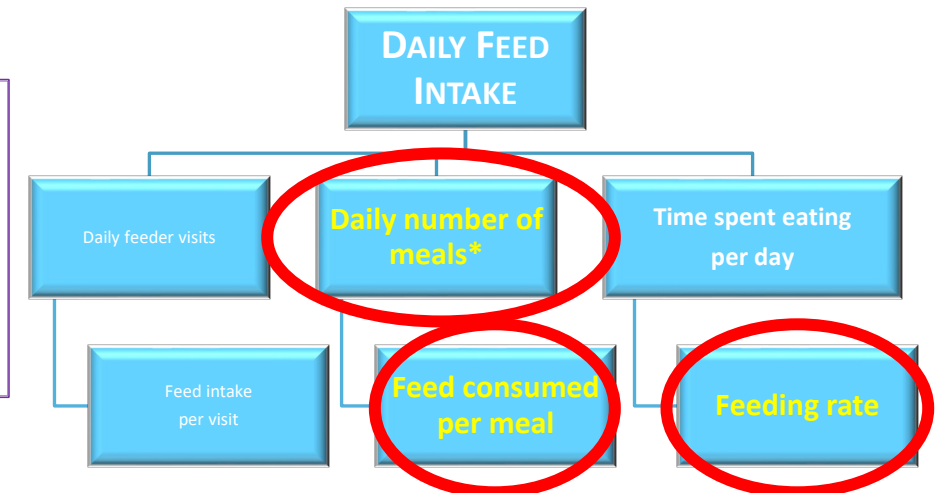
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Relationships between daily feed intake and feeding behavior traits



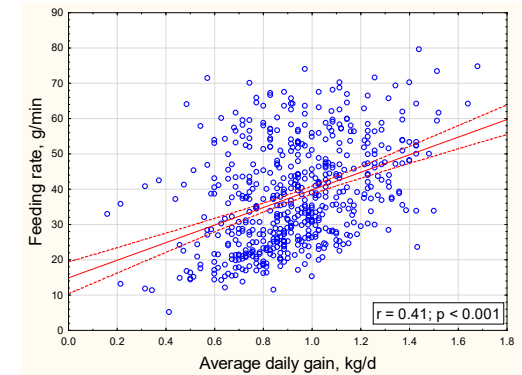
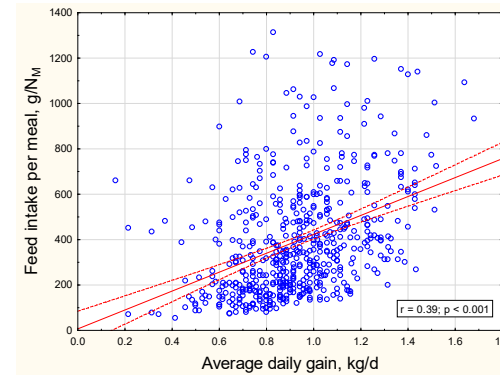
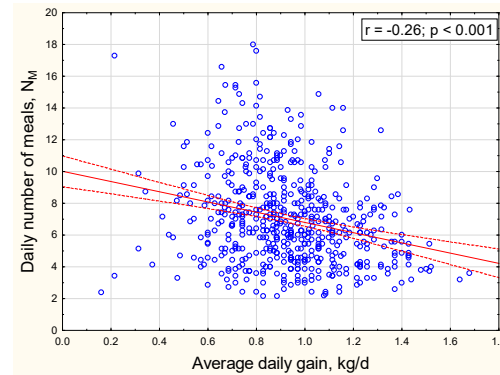
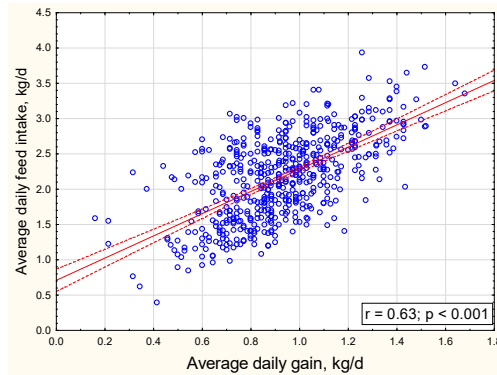
Daily feed intake was positively correlated with the

- Daily number of meals ($r = -0.55$)
- Feed intake per meal ($r = 0.77$)
- Feeding rate ($r = 0.81$)



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Relationship between growth rate, feed intake and feeding behavior



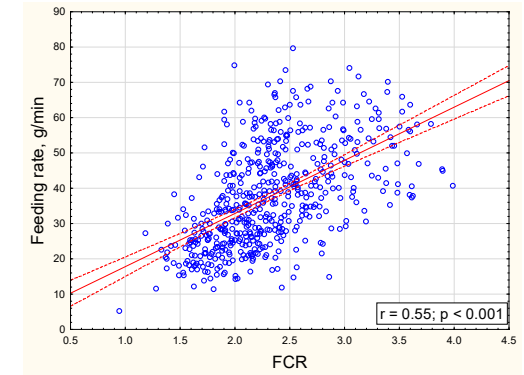
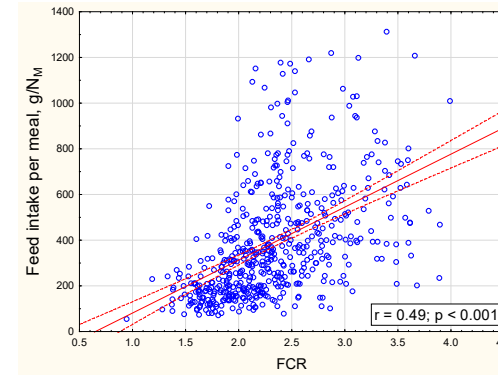
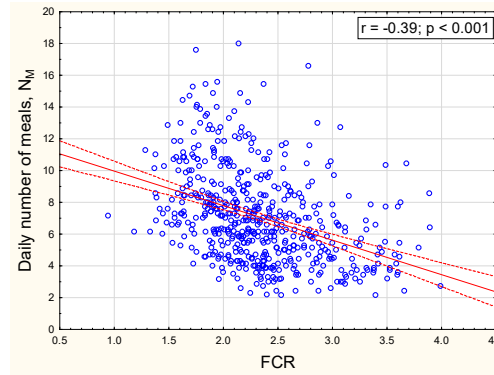
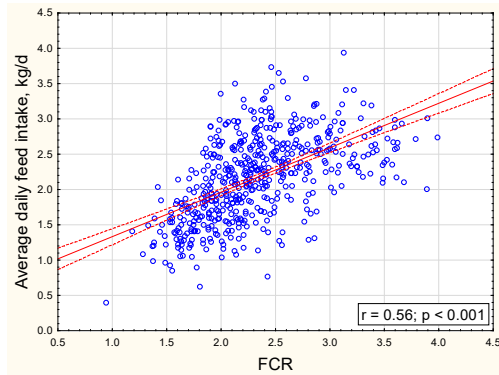
Average daily gain was correlated to

- Daily feed intake ($r = 0.63$)
- Daily number of meals ($r = -0.26$)
- Feed intake per meal ($r = 0.39$)
- Feeding rate ($r = 0.41$)



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Relationship between feed efficiency, feed intake and feeding behavior



Feed efficiency was correlated to

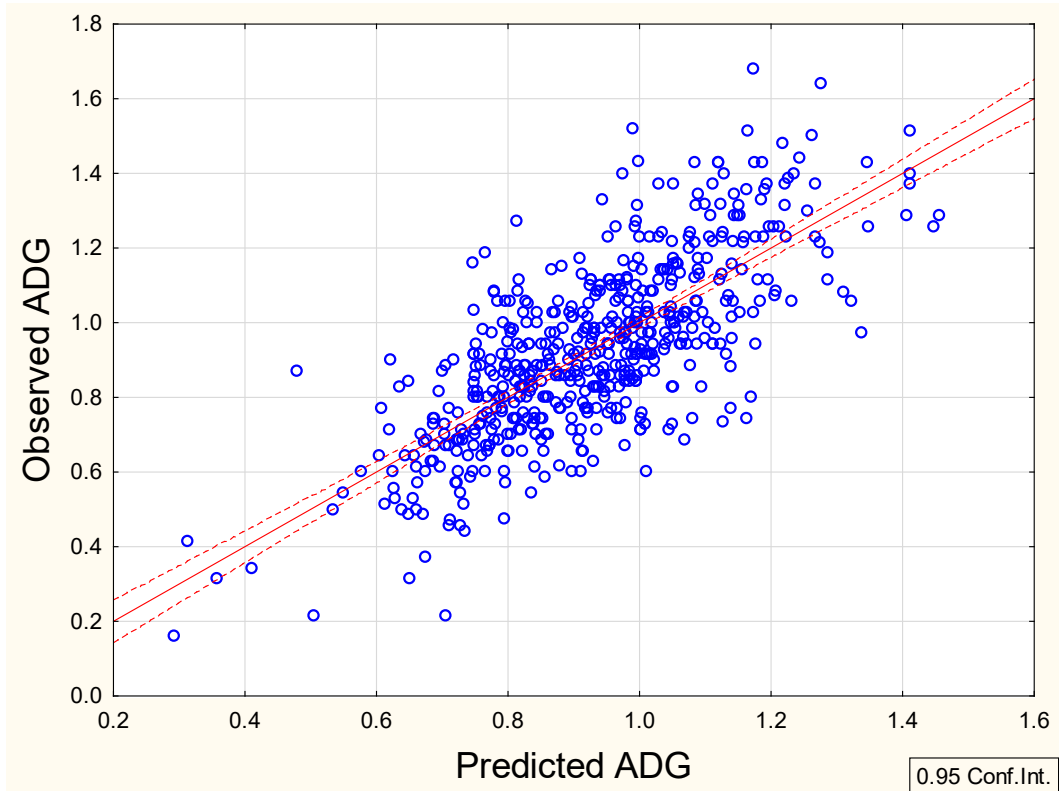
- Daily feed intake ($r = 0.56$)
- Daily number of meals ($r = -0.39$)
- Feed intake per meal ($r = 0.49$)
- Feeding rate ($r = 0.55$)



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Are feed intake or feeding behavior traits proxies for growth rate?

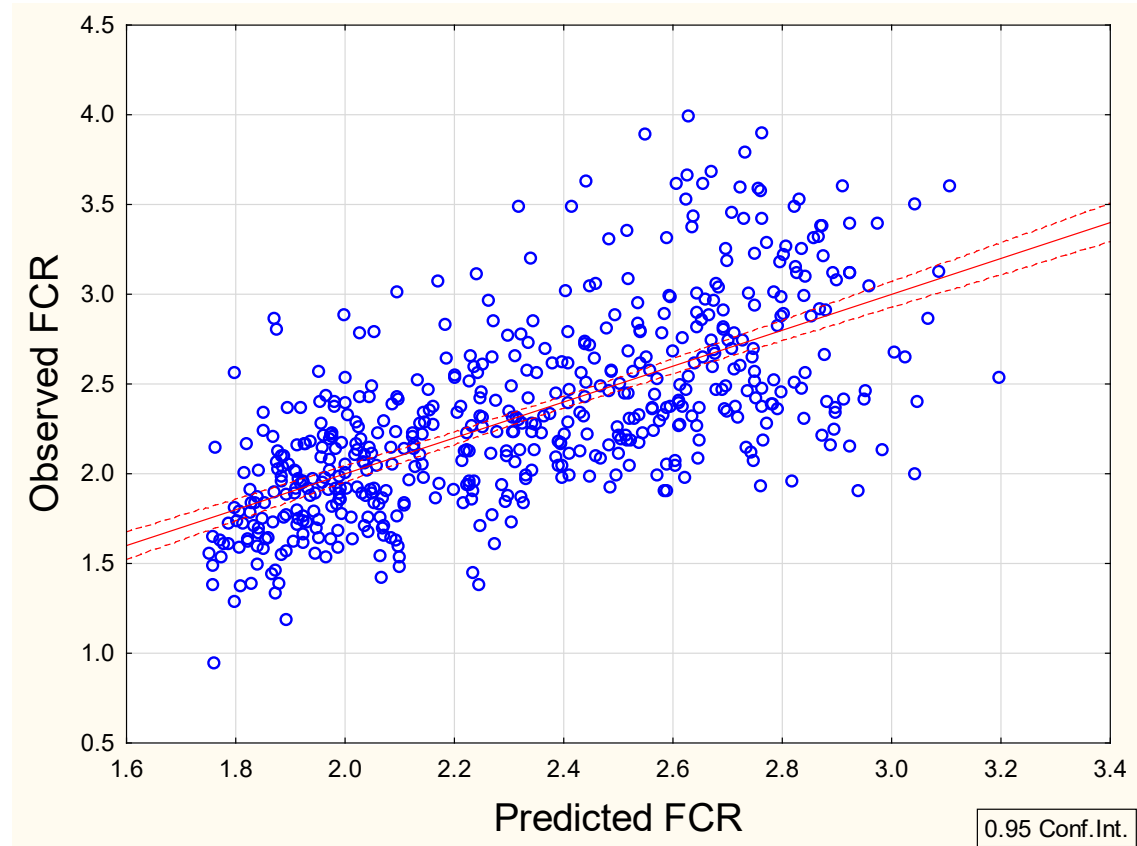
Regression Summary for Dependent Variable: ADG			
R = 0.740			
R ² = 0.547			
Adjusted R ² = 0.545			
Std Error of estimate: 0.159			
	b	SE	p-value
Intercept	0.218	0.029	<0.001
ADFI	0.501	0.023	<0.001
Feeding rate	0.002	0.001	0.043
Body weight	-0.007	0.001	<0.001



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Are feed intake or feeding behavior traits proxies for FCR?

Regression Summary for Dependent Variable: FCR			
R = 0.675			
R ² = 0.454			
Adjusted R ² = 0.451			
Std Error of estimate: 0.391			
	b	SE	p-value
Intercept	2.266	0.228	> 0.001
Body weight	0.017	0.002	> 0.001
IIFI	-0.001	0.000	0.002
Time spent eating	-0.006	0.002	0.010
Feeding rate	-0.012	0.004	0.002



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Conclusion

Objective 1)

To analyze how feed intake patterns influence growth performance traits and nutrient efficiency in growing pigs.

- Daily feed intake is shaped by how much pigs eat during each visit, the time they spend eating per day, and the speed at which they consume their feed.
- These feeding habits also influence their growth rate and their feed efficiency.

Objective 2)

To explore the potential of feeding pattern as proxies to predict growth rate and feed efficiency.

- Daily feed intake, along with body weight and feeding rate are key factors that determine weekly growth rate.
- Daily feed efficiency, along with body weight, IIFl, time spent eating and feeding rate are key factors that determine weekly feed efficiency.



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