**Heart rate as predictor of heat production at different reproductive stages in second parity free-ranging sows.**

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**Keywords: Distance, energy requirement, gestation, heart rate, lactation, organic sows.**

*Max 300 words:*

Indirect calorimetry is not an applicable approach to estimate heat production (**HP**) in free-ranging sows. However, oxygen consumption is a main determinant of HP and linearly related to heart rate (**HR**). Thus, the objective was to investigate the relationship between sow HR and HP as a method to estimate HP of free-ranging sows.

Sow HR was recorded and HP was estimated in eight second parity sows during gestation (day 30, 60, 80 and 104) and during lactation (day 10, 17 and 24) using indirect calorimetry (Dataset-1). Two groups of free-ranging second parity sows (n=41) were used to record HR and distance covered on day 60 and 100 of gestation and on day 5, 20 and 40 of lactation using activity gauges (Dataset-2). Daily HR was calculated as an overall mean of each day and HR during inactivity was obtained as an average of HR when distance = 0 meter/minute. The 24-hour HR was then estimated as a weighted average of the daily HR (sunrise to sunset) and HR during the night (sunset to sunrise represented by HR during inactivity). The mixed procedure (SAS 9.3) was applied to analyze the two datasets.

Sow HP, MJ/d (R2=0.62) = 0.323 (±0.025; *P*<0.001) × HR, bpm – 2.4 (±2.3; *P*=0.33) during gestation and: HP, MJ/d (R2=0.25) = 0.118 (± 0.034; *P*=0.003) × HR, bpm + 26.7 (± 3.4; *P*<0.001) during lactation. The HP of free-ranging sows was calculated from these equations and was found to increase from 27 to 30 MJ/day from day 60 to 100 in gestation (*P*<0.001). Sow HP increased slightly from 38 MJ/day on day 5 to 39 and 40 MJ/day on day 20 and 40 in lactation (*P*<0.001).

In conclusion, HR was linearly related to HP, and was found to increase by 48% from mid-gestation to late-lactation in free ranging sows.

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|  |  | Reproductive stage7 | | | | |  |  |  |  |
|  |  | 60 | 100 | 5 | 20 | 40 |  | SEM |  | P-val |
| Heart rate, bpm | |  |  |  |  |  |  |  |  |  |
|  | Not moving1 | 83d | 94c | 92c | 97b | 101a |  | 1.4 |  | <.0001 |
|  | Walking2 | 110c | 120b | 139a | 140a | 139a |  | 2.4 |  | <.0001 |
|  | Measured mean3 | 96d | 102c | 101c | 114b | 119a |  | 1.7 |  | <.0001 |
|  | 24 hour-mean4 | 91d | 99c | 98c | 108b | 113a |  | 1.5 |  | <.0001 |
| Daily distance, m5 | | 3357a | 2428b | 1077c | 2042b | 2309b |  | 174 |  | <.0001 |
| Heat Production, MJ/d6 | | 27d | 30c | 38b | 39a | 40a |  | 0.3 |  | <.0001 |
| 1 | Heart rate during 1-minutes intervals where the distance covered was zero. | | | | | | | | | |
| 2 | Heart rate during 1-minutes intervals where the distance covered was > 10 meter/minutes. | | | | | | | | | |
| 3 | Heart rate recorded during daytime (9 h and 23 minutes; minimum 5h and 23 min; max 13 h 54 min). | | | | | | | | | |
| 4 | 24h heart rate estimated as a weighted average of heart rate during day time (represented by the measured heart rate) and heart rate during the night time (represented by the heart rate of not-moving periods. | | | | | | | | | |
| 5 | Daily distance covered between sunrise and sunset estimated using the recorded distance adjusted for the ratio between time from sunrise to sunset and the time period of actual recordings. | | | | | | | | | |
| 6 | Heat production estimated from the 24 hour-mean heart rate using following equations. Gestation-equation: HE, MJ/d = 0.323 \* Heart rate, bpm -2.4. Lactation-equation: HE, MJ/d = 0.118 \* Heart rate + 26.7. | | | | | | | | | |
| 7 | Day 60 and 100 in gestation and day 5, 20 and 40 in lactation | | | | | | | | | |