Remote Meat Control

flexibility for sustainability

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Challenges in meat inspection

- Meat control to be done on-site
- A lot of travelling
- Calibration difficult to be done
- Logistical problems for food businesses
 - External hurdles
 - Internal hurdles
- Working environment
 - Reasonable use of veterinary competence



Swedish red meat production

Slaughtered domesticated animals 2022

- Pigs about 2 650 000
- Cattle about 412 000 •
- Sheep about 227 000 •

Semi-domesticated reindeer 2022 About 50 000 reindeer slaughtered Source: www.slv.se







Big wild game 2020

handling establishments

species)

Source: www.slv.se

Source: www.slv.se



Swedish conditions - reindeer slaughter



- 13 red dots are reindeer abattoirs up and running seasonally (top season in November- December)
- 7 blue dots are offices for official control veterinarians and auxiliaries

Calculation:

- About 50 000 reindeer slaughtered in 12 reindeer abattoirs
- Control staff drove about 60 000 kilometres for these meat inspections
- ♦ 24 kg mean carcass weight \rightarrow 1 200 tons meat
- 20 kg (0.8 carcasses) per 1 kilometre

Incentives in Swedish context

- Smaller environmental burden from control
- Higher level of resilience
- Better logistics for FBO
- Lower costs of control





Possibilities to develop control

Official Controls Regulation (EU) 2017/625 Article 16.2:

"the Commission shall take into account the following:

a) The experience gained

b) Scientific and technological developments".....



Remote meat inspection model

Model study 2021 -2023





Studies done and on-going

Post mortem study 2019

Material and methods

- 400 pig carcasses and organs checked twice
- Off the ordinary slaughter line
- PMI filmed and checked again after six months
- Both veterinarians checked every carcass with both methods
- Software XMReality Remote Guidance
- Augmented reality
- Filmed material checked by 9 more official veterinarians (OV)



Photo: V. Almqvist ©

Almqvist et al., 2020

Results PMI study 2019



Percentage-based agreement between raters. See further Almqvist 2021, PhD, thesis No.2021:72, Swedish Univ. Agr Sciences.

Post-mortem - by smartphone and pc

- Material and methods (2021)
- Smartphone WiFi on-site, fiber net (100 MB)
- Pc WiFi at the office, fiber net (100 MB)
- Own software (JITSI) to measure datalosses
- Six establishments, many OV on-site
- Base line measurements done on-site
- Technical support personnel on-site (not official staff)
- PMI performed on many animal types, in total 3 273 carcasses
- PMI codes used Swedish Food Agency standard instruction





Post mortem – by smartphone and pc

Conclusions - 2021

- \succ The main hurdle was the bandwidth at PMI-position
- ➤Smartphone a useful device
- Good technical assistance on-site needed
- Inter-rater variability exists
- Some codes more consistent than others
- Remote control method does not negatively affect the reliability
- > Food safety, animal health or animal welfare not compromised
- Training to use the method is needed
- Possibility to on-site visit remains



Ante mortem - by smart phones at small abattoir

- Material and methods 2022
- Performed by commercial soft ware (FaceTime)
- Sender trained abattoir staff:
 - Wi-Fi in lairage, fiber (100 Mbit/s) at abattoir
- Receiver research veterinarian:
 - Wi-Fi at office via incoming fiber (100 Mbit/s)
 Remote control in parallel with routine ante mortem done by OV on-site
 In total 1 177 animals during 11 March-16 Dec 2022



Ante mortem - by smart phones at small abattoir

Conclusions

- > Data is small but unique,
 - few findings, healthy animals
- > Both sender and receiver were
 - comfortable with smartphone technics
- > Fewer findings recorded by OV on-site than on remote
- Remote control method does not negatively affect the reliability
- > Inter-rater variability do exists, some codes more consistent





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Behavioral studies - preliminary results

Four hypothetical effect categories according the interviews of the control staff



Hunka et al, 2023. in peer review.

Our future vision

Meat inspection can be done on distance

- when well defined circumstances fulfilled
 - With good technical IT- environment
 - with good technical FBO support
 - by well trained control staff

Sustainability Resilience Good working environment

Thank you for your attention!



