Animal welfare and meat quality: on-farm slaughter of Cinta senese pigs

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Transport and lairage before slaughter are critical stressors for pigs, particularly in extensive systems and local breeds. Stress compromises animal welfare and may affect meat quality and safety. On-farm slaughter (OF) has been proposed as an ethical alternative to traditional slaughter (TS), but evidence on local pig breeds is scarce.

Forty Cinta senese barrows reared outdoors in Tuscany were slaughtered between June 2021 and August 2022 using two methods (TS vs. OF). A mobile on-farm prototype was designed and validated. Physiological stress indicators (cortisol, creatine phosphokinase-CPK, lactate dehydrogenase-LDH), meat quality traits (pH, color, water holding capacity), and carcass/meat microbiological loads were assessed. Climatic effects were considered using the Temperature-Humidity Index (THI).

OF pigs showed significantly lower cortisol (29.1 vs 95.8 ng/mL; $P = 0.041$), LDH (1280.0 vs 1495.8 U/L; $P = 0.014$), and CPK (1548.7 vs 2241.0 U/L; $P = 0.030$) than TS pigs, confirming reduced stress. Meat from OF animals had lower pH 48 h post-mortem (5.84 vs 6.14; $P = 0.041$), suggesting improved glycolysis and preservation. No Salmonella or Listeria monocytogenes were detected. Carcass microbial loads did not differ significantly, though mesophilic counts tended to be lower in OF carcasses. THI influenced microbial loads in meat but not in carcasses.

On-farm slaughter markedly reduced physiological stress without compromising microbiological safety or technological meat quality. Beyond its scientific outcomes, the project represents a concrete example of participatory innovation, born from an ethical need expressed by a farming enterprise and developed through collaboration with health authorities and university research, with the aim of proposing more sustainable and ethical solutions. In this context, the Regulation (EU) 2021/1422 - which amended provisions on official controls to allow slaughter at the holding of provenance - opens the way to wider implementation of on-farm slaughter. This regulatory shift enhances the social pillar of sustainability by strengthening rural communities, safeguarding animal welfare, and supporting short food chains. Overall, the results highlight the potential of on-farm slaughter to integrate welfare, food safety, and local development objectives, while calling for further research to optimize its adoption under different farming and climatic conditions.

Keywords: animal welfare; local pig breeds; on-farm slaughter; stress biomarkers; meat quality.