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# Oral Presentation Abstract 1

## Hyperflexing horses' necks – meta-analysis and cost-benefit evaluation

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A review of the scientific literature identified 55 articles dealing with the effects of equine head and neck postures (HNP) on welfare (n=42) and/or gymnastic outcomes (n=35) such as kinematics, muscle activity, respiratory related issues or overall workload. In the dataset for the meta-analysis we coded overall results of the individual studies as follows: positive (1), contradictory or insignificant (0) or negative (-1) influences on a) welfare and b) gymnastics. Information on the reported features of hyperflexion (e.g., degree and duration), the horses (e.g., level of dressage training), and quality and design of the study (e.g., whether or not the study's conclusions were supported by data) was also integrated into the dataset. The significant majority of studies (88%;  $Z=4.94$ ;  $P<0.0001$ ) indicated that a hyperflexed HNP negatively impacts welfare. Only one study suggested positive effects on welfare. Reasons for compromised welfare included impeded ventilation, pathological changes in the structures of the neck, impaired forward vision, and stress and pain due to these factors as well as the rider intervention necessary to achieve the posture. An across-study analysis using a mixed model revealed that the probability of a study reporting negative welfare effects was unrelated to any of the investigated factors such as horses' familiarity with the posture, level of dressage training, duration of the HNP or size and quality of the study (all  $P>0.1$ ). While gymnastic benefits were described in 26% of the studies, a similar proportion of studies (23%,  $P>0.1$ ) detected undesirable gymnastic consequences of a hyperflexed HNP. The remaining studies (46%) described insignificant or contradictory effects on gymnastics. Desired gymnastic effects included higher dressage scores, a larger range of motion in the back or legs or an increased overall workload, while undesired gymnastic effects included lower dressage scores, increased activation of lower neck muscles and reduced oxygen supply due to obstruction of upper airways. Studies conducted on highest level dressage horses and on horses familiar with a hyperflexed HNP were more likely to describe gymnastic benefits than studies conducted on non-dressage horses or those unfamiliar with the posture (both  $P<0.05$ ). These findings question whether any desirable effects of this training method are based solely on biomechanical relationships. Instead, the effects may be the result of horses learning to respond to the cues associated with hyperflexed HNPs with desired changes in posture or movements.

LP: Based on a comprehensive review of the scientific literature, the presumed gymnastic benefits of training horses in a hyperflexed head and neck posture are by far outweighed by both undesired gymnastic effects and reduced equine welfare. A statistical analysis across the studies revealed that negative effects on welfare prevail regardless of the circumstances under which hyperflexion is practiced.