

# The range and prevalence of pathological abnormalities associated with lameness in working horses from developing countries

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**TABLE 01:** Descriptions of data collected, and methods used, from 224 working draught horses in India and Pakistan, showing the prevalences and severities of selected variables for (A) the whole horse and (B) the fore- and hindlimbs separately, per horse.

(A)	Variable	Description	Prevalence (% of horses unless otherwise stated in variable column)	
			India (n = 108)	Pakistan (n = 116)
<b>General characteristics</b>				
	Sex	Mare/filly, stallion/colt or gelding	66, 32, 2	83, 15, 2
	Age group (years)	< 5, 5–15 or >15	19, 46, 35	2, 32, 66
	Demeanour	Alert, apathetic or severely depressed	79, 19, 2	97, 3, 0
	Body condition score	1, 2, 3, 4 or 5 (very thin–very fat)	12, 78, 10, 0, 0	30, 49, 18, 3, 0
	Height (mean ± s.e.)	Measured from ground to highest point of withers (cm)	131 ± 0.9	141 ± 0.5
	Length (mean ± s.e.)	Measured from point of shoulder to <i>tuber ischii</i> (cm)	140 ± 0.9	155 ± 0.7
	Weight (mean ± s.e.)	Measured using a weigh-tape around the girth (kg)	232 ± 3.8	298 ± 3.6
<b>Foot conformation and pathology</b>				
	Abnormal sole structure	Sole structure is flat, convex or mixed in at least one foot	80	63
	Shoes on all 4 feet	Shoes present on all 4 feet	74	51
	Shoes on 1–3 feet	Shoes present on 1–3 feet only	20	24
	Poor shoe fit (% of shoes)	Shoes present do not follow foot circumference and/or do not extend to the most palmar/plantar extremes of hoof wall.	97	95
	High nail position	Nail heads visible in the middle or upper third of the hoof wall in at least one foot	46	44
	Hoof wall rings	Multiple prominent rings present in the hoof wall	74	41
	Increased digital pulse	Digital pulse increased from normal pulse quality in at least one foot	55	38
<b>Spine</b>				
		<b>From poll to sacrum: flexion tests using grass incentive or manual manipulation; pain on palpation; severity and locations of swellings and wounds</b>		
	Cervical spine stiffness on vertical flexion	Inability to flex neck downwards so the mouth touches the ground and/or upwards so the mouth is above eye level	3	21
	Cervical spine stiffness on lateral flexion	Inability to flex the neck to the left and/or right so the mouth touches the side of the body	16	17
	Thoracolumbar spine stiffness on manipulation	Reduced dorsiflexion and/or ventroflexion	76	73
	Thoracolumbar spine pain on manipulation	Behavioural response to spinal dorsiflexion and/or ventroflexion indicative of severe pain	7	19
	Lumbar spine stiffness on lateral flexion	Reduced lateral flexion to the left and/or right	53	71
	Lumbar spine pain on lateral flexion	Behavioural response to spinal flexion indicative of severe pain	17	22
	Skin wounds	Wounds breaking the skin and immediate subcutaneous layers or deeper, >4 cm <sup>2</sup> anywhere along spine or thoracolumbar muscles	23	12
	Scars	At least one scar >4 cm <sup>2</sup> anywhere along the spine or thoracolumbar muscles	60	83

(B)	Variable	Description	Prevalence (% of horses unless otherwise stated in variable column)			
			India (n = 108)		Pakistan (n = 116)	
			Forelimb	Hindlimb	Forelimb	Hindlimb
	<b>Gait</b>	<b>Observations at walk from cranial, lateral and caudal views: lameness score for each limb, ataxia and specific gait abnormalities</b>				
	Lameness score (% of limbs)	0 = sound, 1 = intermittent gait abnormality, 2 = gait abnormality every stride, 3 = consistent gait abnormality impeding forward progress, 4 = nonweightbearing	1, 7, 59, 32, 1	1, 5, 35, 57, 2	1, 7, 54, 37, 1	0, 2, 36, 61, 1
	Ataxia	In-coordination of any limb	9	24	3	6
	Lateral foot strike	Lateral side of the fore foot strikes the ground before the medial side	85	-	62	-
	Toe first	Foot lands toe first	15	27	27	31
	Heel first	Foot lands heel first	40	11	52	26
	Winging in	Foreleg distal to the carpus is swung inwards during the swing phase	54	-	53	-
	Abduction	Leg is swung outwards during the swing phase and then lands laterally on the ground	44	70	68	72
	Low foot flight	Peak height of foot flight is below the coronary band of the contralateral foot	60	86	58	56
	Stiffness	Movement of limb appears stiff, with visibly reduced joint flexion	59	77	85	94
	Vertical hip movement imbalance	Vertical movement of <i>tuber coxae</i> is greater upwards and/or downwards on one side than the other	-	94	-	84
	Lameness on circling	Mild or severe worsening of lameness score when circled right or left	90	99	95	93
	Backing up foot drag	Dragging of foot when backed up	39	72	78	64
	<b>Limb conformation</b>	<b>Observations in all limbs from cranial, lateral and caudal views</b>				
	Toe-out	Toe points outwards from cranial view (forelimbs only)	82	-	82	-
	Coronary band deviation	Coronary band not parallel to the ground surface from cranial view	81	86	92	97
	Carpal valgus	Inward deviation of carpus and outward deviation of cannon from cranial view	90	-	91	-
	Off-set cannon	Cannon set to the lateral side of midline of the carpus from cranial view	71	-	75	-
	Broken back hoof pastern axis (HPA)	Hoof angle less than pastern angle from lateral view	77	50	84	44
	Broken forward HPA	Hoof angle greater than pastern angle from lateral view	14	55	13	62
	Upright pastern	Pastern angle greater than 45°	28	74	91	88
	Forward-at-the-knee	Carpus deviated forwards as seen from lateral view	56	-	50	-
	Sickle hock	Excessive angulation of hock, cannon deviates forwards from lateral view	-	78	-	76
	Straight hock	Very little angulation of hock, limb post-like from lateral view	-	10	-	12
	Cow hock	Hocks deviate inwards as seen from caudal view	-	95	-	97
	Base wide	Distance between feet greater than top of forelimbs at chest from cranial view, or top of hindlimbs at <i>tuber ischii</i> from caudal view	37	28	38	58
	Muscle asymmetry	Muscles viewed from top of forelimbs to withers from cranial view, or from top of hindlimbs to dorsal midline from caudal view	45	53	40	56
	Skeletal asymmetry	Points of the shoulder and scapula from cranial view, or <i>tuber sacrale</i> , <i>tuber coxae</i> and <i>tuber ischii</i> from caudal view	44	44	50	52
	<b>Foot conformation</b>	<b>Observations of all feet</b>				
	Medio-lateral imbalance	Medial and lateral hoof wall angles unequal from cranial view (forelimbs only)	92	-	91	-
	DHW surface concave	Dorsal hoof wall (DHW) surface deviates inwards	68	48	63	41
	DHW:heel angle not parallel	DHW surface angle not parallel to heel angle	97	97	93	96
	Contracted heels	Frog width less than 2/3 frog length, and heel width less than sole width 2.5 cm from toe	100	98	100	97
	Sheared heels	Heel lengths greater than 0.5 cm difference	28	50	24	35
	Asymmetric heels	Heel asymmetry measured using t-square	99	98	100	100
	DHW length disparity	Dorsal hoof wall lengths of contralateral feet differ by 0.5 cm or greater	32	35	27	38
	DHW angle, mean ± s.e.	Dorsal hoof wall angle measured at the dorsal midline	46 ± 0.3	52 ± 0.4	49 ± 0.2	55 ± 0.3
	DHW angle disparity	Dorsal hoof wall angles of contralateral feet differ by ≥5°	22	26	10	20
	Frog nonprotrusion	Frog does not protrude above the sole surface	36	57	21	34

<b>Limb swellings</b>		<b>Scored as: None, Mild (palpable) or Severe (palpable and clearly visible) in all major limb structures; limbs were palpated from distal to proximal</b>			
		<b>Forelimb</b>	<b>Hindlimb</b>	<b>Forelimb</b>	<b>Hindlimb</b>
DIP	Mild or severe swelling of distal interphalangeal joint	88	93	80	90
MCP	Mild or severe swelling of metacarpophalangeal joint	95	-	91	-
MTP	Mild or severe swelling of metatarsophalangeal joint	-	99	-	97
Carpus	Mild or severe swelling of radiocarpal and/or midcarpal joints	83	-	89	-
Tarsus	Mild or severe swelling of tibiotarsal joint	-	Both hind: 100	-	Both hind: 100
Elbow	Mild or severe swelling of elbow	51	-	72	-
Stifle	Mild or severe swelling of stifle joint	-	71	-	68
Flexor tendons (DDFT/SDFT)	Mild or severe swelling of deep digital flexor tendon /superficial digital flexor tendon	65	51	82	74
DFTS	Mild or severe swelling of digital flexor tendon sheath	99	100	98	100
SL	Mild or severe swelling of suspensory ligament	44	58	80	77
<b>Limb wounds</b>		<b>Presence, size, severity, location and type</b>			
Hobbling/tethering	Wounds inflicted by hobbling or tethering horses by the limbs	54	58	60	59
Firing	Wounds inflicted by hot metal items held to the skin	10	11	11	18
Skin wounds	Wounds breaking the skin and immediate subcutaneous layers or deeper, >1 cm <sup>2</sup> anywhere on limb	47	48	96	96
<b>Limb pain on palpation</b>		<b>Scored as: No reaction, Mild (sign of attention or muscular tension) or Severe (limb withdrawal) response to palpation of all main limb structures</b>			
Coronary band	Severe pain response to palpation of coronary band	2	6	9	22
Lower limb	Severe pain response to palpation of DIP out-pouching and/or the MCP/MTP joints	2	2	13	17
Upper limb (fore)	Severe pain response to palpation of carpal joints, elbow and/or shoulder	15	-	52	-
Upper limb (hind)	Severe pain response to palpation of tarsus, stifle and/or hip	-	35	-	51
Tendons and sheaths	Severe pain response to palpation of common digital extensor, deep digital flexor, and superficial digital flexor tendons and/or sheaths	6	10	19	24
Suspensory ligament	Severe pain response to palpation of suspensory ligament	5	11	14	18
Metacarpal/metatarsal bones	Severe pain response to palpation of 2nd, 3rd or 4th metacarpal/metatarsal bones	1	5	15	21
<b>Limb manipulations</b>		<b>Manual manipulation of the limb joints to detect range of motion and pain response; joints were flexed in order from distal to proximal</b>			
MCP/MTP joint flexion stiffness	Reduced flexion of MCP/MTP joint	84	14	99	30
MCP/MTP or distal limb flexion pain	Immediate strong limb withdrawal response to MCP/MTP and/or distal limb flexion	68	27	71	56
Forelimb abduction pain	Immediate strong limb withdrawal response to forelimb abduction	40	-	58	-
Hindlimb full limb flexion pain	Immediate strong limb withdrawal response to flexion of hindlimb so cannon horizontal to ground	-	30	-	74
60 s distal limb flexion test	Mild or severe (nonweightbearing) worsening of lameness score after fixed distal limb flexion for 60 s then walking away	86	95	79	98
60 s carpal flexion test	Mild or severe worsening of lameness score after fixed carpal flexion for 60 s then walking away	85	-	85	-
60 s hindlimb flexion test	Mild or severe worsening of lameness score after fixed hindlimb flexion for 60 s then walking away	-	94	-	98
Foot replacement test delay	Replacement of foot onto the ground when placed onto contralateral foot not immediate	5	23	47	32
<b>Foot pathology</b>		<b>Potentially pathological aspects of the foot including wall, sole, frog, and heels; pain responses in 13 defined areas of each foot</b>			
Infection of frog or heel cleft	Odour and/or discharge from frog or heel cleft	34	51	31	59
Digital pressure pain	Withdrawal response to digital pressure on the frog, heel bulbs and/or 5 points on the sole	9	26	16	32
Hoof testers pain	Withdrawal response to hoof testers on any of the sole, frog, heels or wall points	13	27	23	34
Sole percussion pain	Withdrawal response to brief tap with percussion hammer on any of 5 sole points	62	40	78	68
Frog percussion pain	Withdrawal response to brief tap with percussion hammer on the frog	19	30	35	34
Heel percussion pain	Withdrawal response to brief tap with percussion hammer on either heel bulb	19	27	47	62
Hoof wall percussion pain	Withdrawal response to brief tap with percussion hammer on any of 5 wall points	6	17	20	22

The data are separated by country and leg type for information. Unless otherwise stated, pathologies are recorded as present if they existed in at least one of the horses' legs. Because of the large numbers of measurements taken, results are only presented for variables reaching  $\geq 50\%$  prevalence in India and/or Pakistan. Exceptions include variables likely to be particularly influential on lameness (pain responses, firing wounds, abnormal foot replacement task, ataxia and increased digital pulse), and those variables where the pathology was recorded as more than one mutually exclusive category that together comprise  $\geq 50\%$  abnormality (feet landing toe or heel first, and sickle/straight hocks). HPA = hoof pastern axis; DHW = dorsal hoof wall; DIP = distal interphalangeal joint; MCP = metacarpophalangeal joint; MTP = metatarsophalangeal joint; DDFT = deep digital flexor tendon; SDFT = superficial digital flexor tendon; DFTS = digital flexor tendon sheath; SL = suspensory ligament.