Participant Information Sheet
Version 4
28/10/2024

INSTITUTE OF LIFE COURSE & MEDICAL SCIENCE, UNIVERSITY OF LIVERPOOL

Walking the dog: a multi-scale analysis of selective breeding, limb morphology and biomechanics in dogs

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Invitation and summary

We would like to invite you to allow your dog to participate in a research study. Before you decide whether or not to participate, it is important for you to understand why the research is being done and what it will involve: this is the purpose of this document. Please take time to read the following information carefully and feel free to ask us if you would like more information or if there is anything that you do not understand. Please also feel free to discuss this with your friends, relatives and GP/vet if you wish. We would like to stress that you do not have to accept this invitation and should only agree to take part if you want to.

The first part of the Participant Information Sheet tells you the purpose of the study and what will happen to your dog if you take part. Then we give you more detailed information about the conduct of the study where we explain the potential risks and benefits involved in participation in the study.

Thank you for reading this.

Background of the study: how has selective breeding effected the way your dog walks?

Pet dogs vary enormously in their body size and shape despite belong to the same biological species. This variation in size and shape is the product of artificial selective breeding by humans. Since Victorian times, we have intensely selectively bred dogs with the goal of altering their functional anatomy for specific purposes, such as working tasks, agility or simply ‘desirable’ visual qualities. However, there are major scientific and societal concerns about the welfare implications of the body shapes we have produced for certain breeds and we know that certain breeds suffer more from disease and injury in certain limb joints than other breeds. But at present we do not fully understand why.

The goal of this project to assess if there are links between the body shape of certain breeds and how the weight or loads they place on their joints when they walk may lead to the development of disease/injury in these breeds. In addition, we will also use this data to assess new methodological tools for measuring how pet animals walk in collaboration with an industrial partner.

Our approach: Motion analysis

In this study we will use established motion analysis techniques, routinely used on people, to make direct measurements of how the body and legs of dogs move. Our approach is completely non-invasive and simply requires that we attached small round markers (that are tracked by our infra-red cameras) and small sensors (for measuring muscle activity) to the skin of your dog using double-sided tape. We would also like to weigh your dog and take measurements of the limbs and body

(e.g. thigh length, neck length, belly circumference) to measure each dogs body size/shape. Using these approaches will record information on how your dog moves during normal walking. To supplement this, we'll also record your dog walking with a standard video camera.

In this study we will be using new imaging technologies to make direct measurements of how the bones of the knee and elbow joints move. The new imaging technique – called biplanar x-ray videography – uses two standard x-ray systems and high-speed video cameras to image the knee and elbow as they pass through a "football-sized" volume of space (see Figure 1, below). This technique will allow us to measure the movement of these joints with extremely high accuracy (+/- 0.1mm), and will allow us to understand how fine-scale motions in the knee and elbow vary across breeds that do and not develop regular problems with these joints.

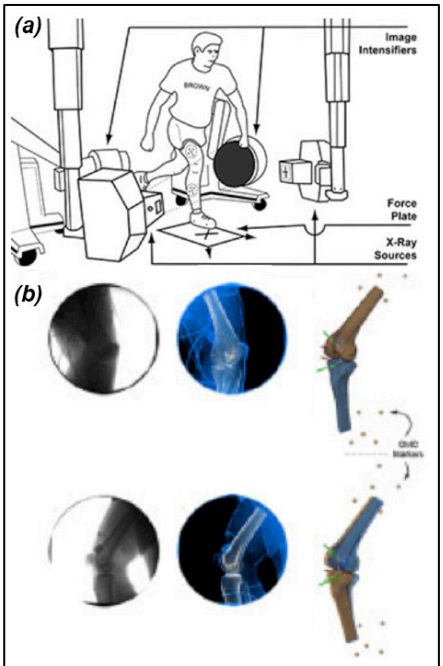

Figure 1. Biplanar x-ray videography applied to the human knee joint (image from Miranda et al. 2013, *Medicine and Science in Sports and Exercise* 45:942-51).

Who are we asking to participate?

We are attempting to recruit two different groups of dogs in this study:

Group 1: Border Collies, Beagles, French Bulldogs, Spaniels, German Shepherds, West Highland White Terriers, Dachshunds, Deerhounds, Great Danes, Yorkshire Terriers, Parsons Russell Terriers and Labrador dogs that have no recent injuries to their body or legs, no balance or stability issues, are free from diabetes, under the age of 8 and who are currently doing 30-90 minutes of exercise per day.

Group 2: Labradors that have been diagnosed with elbow dysplasia and have been prescribed surgical implantation of a Load Shifting Humeral Osteotomy as part of routine veterinary practice by their own veterinarian.

Group 3: Dogs from one our 12 breeds (see Group 1) that have previously diagnosed with a limb injury or dysfunction/disease (e.g. arthritis) that is likely to be impacting on the way they walk. They should be aged between 1 and 8 years old and currently undertaking 30 minutes of exercise per day (or more). They should have a confirmed diagnosis of an orthopaedic problem by your vet and ideally x-rays to support this.

What will participants do?

Motion analysis will be carried out within the William Henry Duncan Building at the University of Liverpool. Dogs will be asked to walk with around 45 small infrared markers and sensors attached to the skin with sticky tape. A special camera system will track the motion of infrared markers attached to the skin, and we may also occasionally record standard video (without sound). While taking these measurements, dogs will carry out the following activities:

- Static recordings with the dog stood still with both forelimbs on one force plate and both hind limbs on a second force plate.
- Standard straight-line walking or trotting over a distance of approximately 15m. Dogs will be led by you or one of the investigators on a 2m lead, which is of sufficient length to maintain slackness in the lead to minimise the impact of the investigator on natural locomotion. We will collect 15 trials per dog.
- We will then repeat those two activities (standing and walking) in our bi-planar x-ray lab.

The recording equipment will be controlled by the researchers: these may include the named investigators and trained technicians from the Institute of Life Course & Medical Science's gait lab. They will provide you with explanations and background information on the experiments and the equipment being used and will help you and your dog acclimatise to the room and practice the experiment until you are comfortable that your dog is familiar and happy with the exercise. The

investigators are happy to elaborate on any details and answer any questions you have regarding the experiment.

How long will participation take?

We anticipate that participation in the study will require approximately 1-1.5 hours and will involve two visits to the gait lab within Institute of Life Course & Medical Science (William Henry Duncan Building) on the main University of Liverpool campus. For the healthy dogs in **Group 1**, these visits will take place approximately two years apart, allowing us to measure how the way your dog walks has changed across the two year period. For the Labradors in **Group 2** undergoing a Load Shifting Humeral Osteotomy, the two visits will take place before and after surgery, with timing decided upon in consultation with your veterinary surgeon. Dogs from Group 3 will only undertake one visit, which will be shorter (approximately 45 minutes) because it is not necessary to collect x-ray data on these dogs.

What are the risks from participation?

The potential for physical or psychological adverse effects resulting from this research are minimal. The work carried out in our gait lab using standard and infra-red cameras is non-invasive and will only require a moderate level of physical exertion (walking or trotting) from the dogs. There is a minimal risk of trips/falls during the locomotion experiments, but this risk will be similar to that experienced during everyday life/exercise.

For dogs in Group 3, A veterinarian will be present and will conduct a clinical exam and collect a brief clinical history from the owner before the dog participates in any gait data collection to ensure they feel it is appropriate for the dog to participate. The veterinary surgeon will monitor the dog during the experiment. This will include assessing the dog's comfort with the environment and the tasks being performed. The veterinary surgeon's role in this study is to safeguard the health and welfare of the dogs while acting as a clear advocate for the owners, ensuring any concerns about their dog's well-being are promptly heard and addressed.

Biplanar x-ray videography, **collected on dogs in Groups 1-2 (but not Group 3)** involves exposure to ionising radiation. The dosage received will be more than you would receive from a routine x-ray for diagnosis of a clinical condition and it is important that participants understand the level of risk. Exposure to ionising radiation carries a hypothetical risk that it may cause a cancer later in life after a delay called the latency period. For example, in humans the latency period is from 2-10 years for leukemia, and up to several decades for solid tumours. There is no established or standard model for converting radiation dose measurements to risk of cancer in dogs. We have set a maximum dose level of 0.15mSv, which is the same maximum values we use in human studies (Figure 1). The lifetime risk of cancer this radiation dose for a human is estimated to be about 1 in 130,000 (or about 0.00075%). It is approximately equal to 20 days' worth of natural background radiation. This dose (0.15mSv) is the maximum we would ever allow for your dog and would only be reached if we collected a very large number of repeat trials through the x-ray volume. Because we are restricting this study to 3 successful trials per dog it is likely that the dose received by your dog will be much lower. Your dog will wear a small Tracerco personal electronic dosimeter on its collar, which will allow us to continually monitor radiation exposure.

Co-investigators Professors Comerford and Maddox are practicing veterinarians and will be happy to discuss any concerns you may have before or during participation. If you are unsure about any of these details related to radiation exposure or have further questions please contact the principle investigator or the University of Liverpool's Radiation Protection Advisor and Medical Physics Expert Professor Peter Cole (email: pcole@liverpool.ac.uk; telephone: 0151 794 3467). You may also find the following websites useful:

https://www.gov.uk/government/publications/ionising-radiation-from-medical-imaging-examinations-safety-advice/exposure-to-ionising-radiation-from-medical-imaging-safety-advice

https://www.gov.uk/government/publications/medical-radiation-patient-doses/patient-dose-information-guidance

Will I benefit directly from participation?

Dog owners will receive a £10 amazon voucher per visit (i.e. £20 in total) as a reimbursement for their time and inconvenience. The benefits of this study are largely medium-longer term. Improved understanding of how breeds varying in their anatomy and the way they move will help veterinarians in the longer-term with diagnosis and treatment of mobility and lameness issues in dogs. Therefore, the benefits are very indirect to the actual participant dogs in this case but the project may realise benefits to dogs more widely in the future. All participants taking part in this and other University of Liverpool studies are covered for negligent and non-negligent harm by the University's Clinical Trials Insurance policy.

Will my participation be anonymous?

All data on your dog will be held anonymously. However, please ask if you would like to be given a copy of any publication or a copy or movies of your recordings if you wish: but in this case we will need to keep your name and email in a coded form (the name and code being accessible only to the Principal Investigator Dr Karl Bates) so that your name and email address can be associated with your data for this purpose only, after which time the name and address will be erased. We do ask you to tell us the age of your dog and we will measure its height, weight and other body proportion measurements. The data will be held on University password-protected computers in this laboratory for this project only. If you want your data securely erased after analysis, please let us know in advance.

The data will be analysed and written up anonymously by researchers and may then be published.

What will happen if a participant does not want to carry on with the study?

You should feel under no pressure to participate and you may withdraw from the study at any point. Results up to the period of withdrawal may be used, if you are happy for this to be done. Otherwise, up to the point when data processing is finalised, you may request that they are destroyed and no further use is made of them. To make such a request, contact the principal investigator Dr Karl Bates (see contact details at the end of this document).

How will my data be used?

The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of 'public task', and in accordance with the University's purpose of "advancing education, learning and research for the public benefit.

Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. The Principal Investigator, Dr Karl Bates, acts as the Data Processor for this study, and any queries relating to the handling of your personal data can be sent to Dr Bates' details as listed below

Further information on how your data will be used can be found in the table below:

How will my data be collected?	No personal data is being collected on human or animals. Only the breed, body mass, body proportions and age of the dogs will be stored.
How will my data be stored?	Data will be collected on laboratory computers, but immediately moved to the project's secure research data management drive and subsequently deleted from the laboratory machine. We will also share standard videos (with no audio) of your dog walking with our industrial collaborator Vet-AI. These videos will be given coded file names,

	which do not contain any personal information about you or your dog (e.g. they won't include your name or your dog's name).
How long will my data be stored for?	10 years
What measures are in place to protect the security and confidentiality of my data?	All data will be kept on the project's secure research data management drive which is only accessible by the named investigators. No data will ever be held on a mobile or non-University networked computer.
Will my data be anonymised?	Yes for all data processing and analysis, up to the point of finalised analysis.
Who will have access to my data?	Only the named investigators.

How do I participate in the study?

If having considered all the information provided, and obtained satisfactory answers to any questions about participation, you would like to participate in the study then you will be asked to sign a consent form. Signing this consent form serves as written confirmation that you understand the requirements, risks and benefits of participation and that to the best of your knowledge you do not violate any of the exclusion criteria stated herein for this study.

What if you are uncertain or have further questions?

If you are unhappy, or if there is a problem, please feel free to let us know by contacting the principal investigator [Dr Karl Bates; 0151 794 9075; k.t.bates@liverpool.ac.uk] and he will try to help. If you remain unhappy or have a complaint which you feel you cannot come to us with then you should contact the Research Governance Officer on 0151 794 8290 (ethics@liv.ac.uk). When contacting the Research Governance Officer, please provide details of the name or description of the study (so that it can be identified), the researcher(s) involved, and the details of the complaint you wish to make.

We would be happy to show you round the lab if it would help you make up your mind whether to participate.

Investigators:

Professor Karl Bates, Principal Investigator
For queries or more information about any of the information below contact the principal investigator via email (k.t.bates@liverpool.ac.uk) or telephone (mobile: 07792595055; office: 0151 794 9075).

Professor Eithne Comerford FRCVS Co-Investigator. Email: ejc@liverpool.ac.uk

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Dr Roger Kissane, Co-Investigator. Email: r.kissane@liverpool.ac.uk

Dr James Gardiner, Co-Investigator. Email: james.gardiner@mmu.ac.uk

Dr James Charles, Co-Investigator. Email: j.charles@liverpool.ac.uk

Professor Thomas Maddox, Co-Investigator. Email: tommad@liverpool.ac.uk

Mr Harry Gill, Co-Investigator. Email: harry.gill2@stu.mmu.ac.uk