Body Composition (DEXA lean/fat) IMPC_DXA_001

Purpose

Measure bone mineral content and density as well as body composition in mice using the DEXA (Dual Energy X-ray Absorptiometry) analyser.

Experimental Design

- **Minimum number of animals :** 7M + 7F
- **Age at test:** Week 14

Procedure

3.1 Calculate and record the volume of anaesthetic solution required for intraperitoneal (IP) injection.

3.2 Anesthetize the mice.

3.3 Monitor the animal carefully until unconsciousness by ensuring that the mouse is adequately sedated.

3.4 Weigh the mouse and record the value.

3.5 Measure the length of the mouse as follows and record the value (accuracy ±0.1cm)

3.5.1 Place the unconscious mouse on a disinfected ruler so that its nose is at zero

(figure 1).

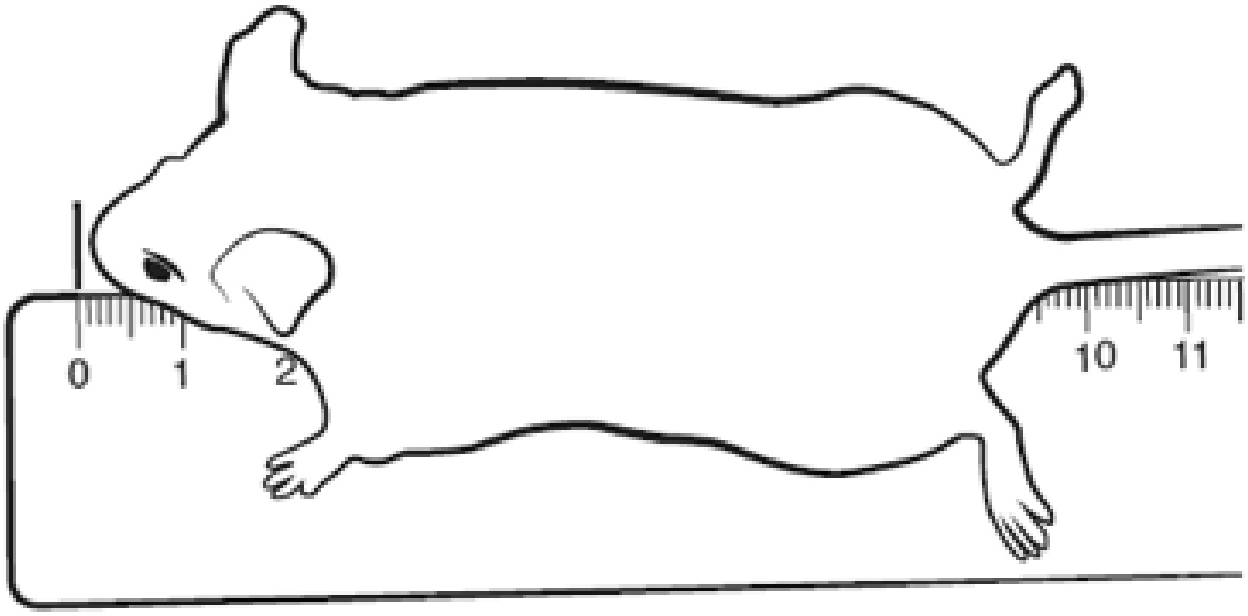

Figure 1

3.5.2 To measure the entire length of the head press gently against the ruler (figure 2) and gently pull the tail to ensure that the spine returns to its full length (figure 3).

Figure 2

Figure 3

3.5.3 Measure the length starting from the nose (0cm) to the beginning of the tail (figure 4). Record the measurement – the accuracy is within 0.1cm. For example in figure 4 the length of the mouse is 9.5cm.

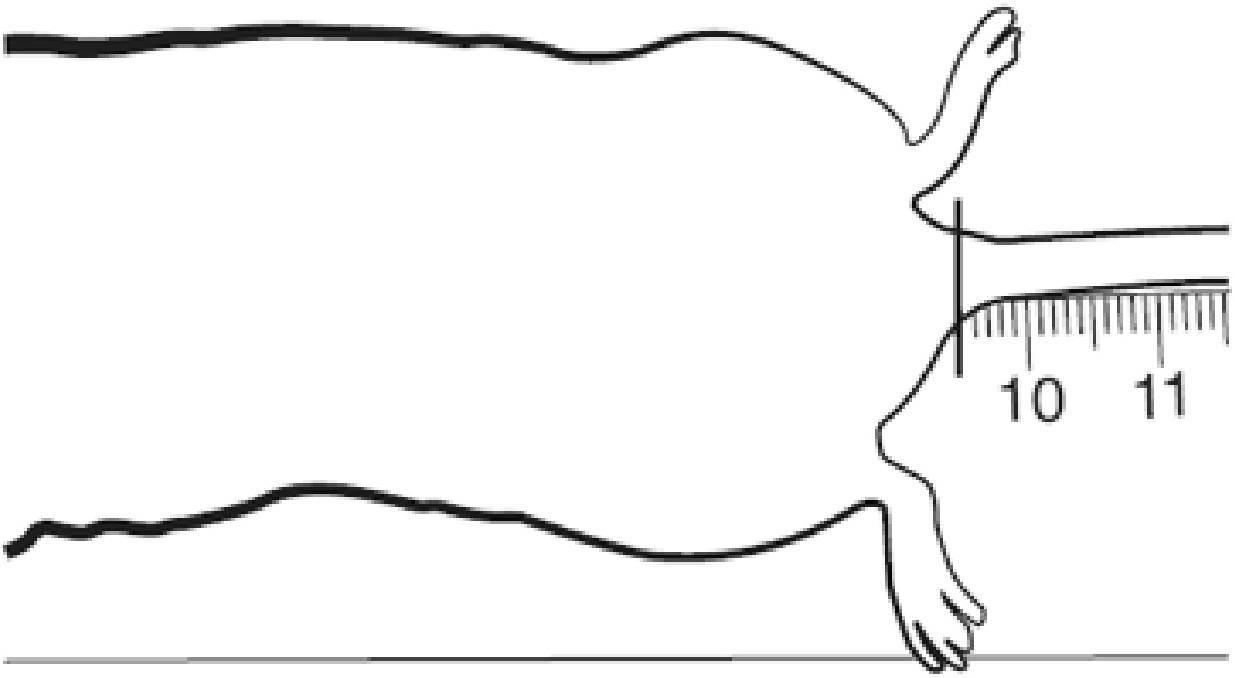

Figure 4

3.5.4 Disinfect the ruler and contact area after the measurement has been taken.

3.6 Place the unconscious mouse into the DEXA analyser.

3.7 Perform a scout-scan.

3.8 Optimise the area of interest and perform a measure-scan.

3.9 Note that the exposure dose per mouse is 300Sv.

3.10 For the analysis of the data, regions of interest must be defined. The standard analysis comprises of a whole body analysis excluding the head area.

Continue with X-ray analysis or

3.11 Remove the mouse once the image is captured. Place the mouse on a heated mat, set at 37ºC, in a cage and monitor closely until consciousness is regained.

Notes

Dual-energy X-ray Absorptiometry (DEXA or DXA) is a method of quantifying bone mineral content and density. DXA uses an X-ray generator of high stability to produce photons over a broad spectrum of energy levels. Its photon output is filtered to produce the two distinct peaks necessary to distinguish bone from soft tissue.

The technique used for separating photon output into two distinct energy levels is known as ‘K-edge’ filtration. By placing a filter element in the beam path, energy levels reacting with the filter material are sharply attenuated. The filter effect gradually lessens at higher energy

levels, and so a second peak is introduced. The tin filter material used in this system produces energy peaks at 28keV and 48keV. Two solid-state detectors and proprietary energy discrimination are used to determine high and low energy counts.

The count data is transformed by software into bone and non-bone components, thus generating the bone density values. Information is generated about body weight, body length, fat and bone mass, bone mass density, and lean mass of each mouse.

Data QC

Calibration of the system is done daily and use of the phantoms delivered by the manufacturer (for BMC, total weight and fat percent) is performed in weekly intervals. The results from the calibration runs are recorded.

Parameters and Metadata

Body weight IMPC_DXA_001_001 | v1.1

simpleParameter

Req. Analysis: false **Req. Upload:** true **Is Annotated:** false

Unit Measured: g

Description: body_weight

Fat mass IMPC_DXA_002_001 | v1.1

simpleParameter

Req. Analysis: false **Req. Upload:** true **Is Annotated:** true

Unit Measured: g

Description: fat_mass

Lean mass IMPC_DXA_003_001 | v1.1

simpleParameter

Req. Analysis: false **Req. Upload:** true **Is Annotated:** true

Unit Measured: g

Description: lean_mass

Bone Mineral Density (excluding skull) IMPC_DXA_004_001 | v1.2

simpleParameter

Req. Analysis: false **Req. Upload:** false **Is Annotated:** true

Unit Measured: g/cm^2

Description: bone_mineral_density_excluding_skull_

Bone Mineral Content (excluding skull) IMPC_DXA_005_001 | v1.2

simpleParameter

Req. Analysis: false **Req. Upload:** false **Is Annotated:** true

Unit Measured: g

Description: bone_mineral_content_excluding_skull_

Body length IMPC_DXA_006_001 | v1.2

simpleParameter

Req. Analysis: false **Req. Upload:** false **Is Annotated:** true

Unit Measured: cm

Description: body_length

BMC/Body weight IMPC_DXA_007_001 | v1.3

simpleParameter

Req. Analysis: false **Req. Upload:** false **Is Annotated:** true

Unit Measured: ratio

Description: bmc_body_weight

Derivation: div('IMPC_DXA_005_001', 'IMPC_DXA_001_001')

Lean/Body weight IMPC_DXA_008_001 | v1.3

simpleParameter

Req. Analysis: false **Req. Upload:** false **Is Annotated:** true

Unit Measured: ratio

Description: lean_body_weight

Derivation: div('IMPC_DXA_003_001', 'IMPC_DXA_001_001')

Fat/Body weight IMPC_DXA_009_001 | v1.3

simpleParameter

Req. Analysis: false **Req. Upload:** false **Is Annotated:** true

Unit Measured: ratio

Description: fat_body_weight

Derivation: div('IMPC_DXA_002_001', 'IMPC_DXA_001_001')

Bone Area IMPC_DXA_010_001 | v1.3

simpleParameter

Req. Analysis: false **Req. Upload:** false **Is Annotated:** true

Unit Measured: cm^2

Description: bone_area_bmc_bmd_

Derivation: div('IMPC_DXA_005_001', 'IMPC_DXA_004_001')

Equipment ID IMPC_DXA_011_001 | v1.0

procedureMetadata

Req. Analysis: false **Req. Upload:** true **Is Annotated:** false

Description: equipment_name

Equipment manufacturer IMPC_DXA_012_001 | v1.1

procedureMetadata

Req. Analysis: true **Req. Upload:** true **Is Annotated:** false

Description: equipment_manufactuer

Options: GE Medical Systems, Norland Stratec, Bruker, Faxitron Bioptics LLC,

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Equipment model IMPC_DXA_013_001 | v1.0

procedureMetadata

Req. Analysis: true **Req. Upload:** true **Is Annotated:** false

Description: equipment_model

Options: Lunar Piximus II, Sabre, Minispec LF50, Minispec MQ 10, UltraFocus 100, UltraFocus DXA, UltraFocus DXA Xray tube #2, Minispec LF90,

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Mouse Status IMPC_DXA_014_001 | v1.0

procedureMetadata

Req. Analysis: false **Req. Upload:** true **Is Annotated:** false

Description: mouse_status

Options: Anesthetized, Dead, Awake,

Anesthesia IMPC_DXA_015_001 | v1.0

procedureMetadata

Req. Analysis: false **Req. Upload:** true **Is Annotated:** false

Description: anesthesia

Options: Avertin, Ketamine+Xylazine, Isoflurane, Euthatal, Tribromoethanol, Domitor+Ketamin, Ketamine+Xylazine+Antisedan, Pentobarb, No anesthesia, Medetomidine+Midazolam+Butorphanol,

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Experimenter ID IMPC_DXA_016_001 | v1.0

procedureMetadata

Req. Analysis: false **Req. Upload:** true **Is Annotated:** false

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Date equipment last calibrated IMPC_DXA_017_001 | v1.2

procedureMetadata

Req. Analysis: false **Req. Upload:** false **Is Annotated:** false

HAW IMPC_DXA_018_001 | v1.1

procedureMetadata

Req. Analysis: true **Req. Upload:** false **Is Annotated:** false

Unit Measured: g/cm^2