Grip-Strength ESLIM_009_001

Purpose

The grip test is used to measure the maximal muscle strength of forelimbs and combined forelimbs and hind limbs as a primary phenotype screen. In the EMPReSSslim pipeline it is performed directly following the modified SHIRPA. Three trials are carried out consecutively measuring forelimb-strength only, followed by three trials testing consecutively the combined forelimb/hindlimb grip strength.

	Title: Grip Strength Test	
Standard Operating Procedure	Doc. Number: ESLIM_009_001Rev No. 1	Date Issued: 06/08/2008

1.0 Purpose:

1.1 The grip test is used to measure the maximal muscle strength of forelimbs and combined forelimbs and hind limbs as a primary phenotype screen. In the EMPReSSslim pipeline it is performed directly following the modified SHIRPA. Three trials are carried out consecutively measuring forelimb-strength only, followed by three trials testing consecutively the combined forelimb/hindlimb grip strength.

2.0 Scope:

2.1 This procedure must be followed by individuals who have been trained and are competent in performing the procedures described herein.

2.2 Any queries, comments or suggestions, either relating to this SOP in general or to a specific problem encountered during a procedure, should be addressed to the Head of Phenotyping Facility.

2.3 Any deviances from this protocol must be reported to the Head of Phenotyping Facility.

3.0 Safety Requirements:

3.1 General laboratory procedures should be followed, which include: no eating, no drinking, no chewing gum, no applying of cosmetics in the work area. Laboratory coats and gloves must be worn at all times in the work area.

4.0 Associated Documents:

5.0 Notes

5.1 Mice with missing digits (e.g. after toe clipping) should be omitted from this test

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5.2 Environmental factors may contribute to the levels of anxiety within the mouse. The temperature, humidity, ventilation, noise intensity and lighting intensity must be maintained at levels appropriate for mice. It is essential that the mice are kept in a uniform environment before and after testing to avoid anomalous results being obtained.

5.3 It is recommended that all phenotyping experimentation is conducted at approximately the same time of day because physiological and biochemical parameters change throughout the day.

5.4 Body weight will influence grip force in most mice. Thus, consideration of the body weight is essential for better evaluation of the muscle strength.

6.0 Quality Control:

6.1 Follow the manufacturers' instructions to ensure the consistency of the data (e.g. battery loading).

6.2 The force sensor is fragile and should never be overloaded. Be careful not to apply strength greater than the nominal capacity of the sensor or it could be permanently damaged.

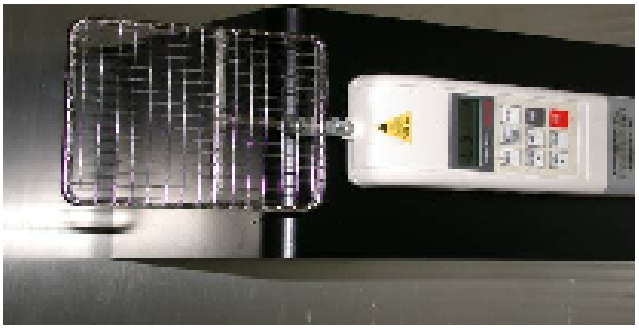
7.0 Equipment:

7.1 Commercially available (Bioseb or TSE) Grip Strength Meter apparatus which measures the gripping strength of mice. The system is supplied with a single grid which connects to the sensor.

7.2 Data acquisition: Dependent on the device used the data are recorded manually or automatically.

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8.0 Supplies:

8.1 50% Ethanol

8.2 Tissue paper

9.0 Procedure:

9.1 **Set up and use of instrument:**

9.1.1 Check that the connection of the sensor to the grid is tight to prevent the grid from turning on itself.

9.1.2 Turn on the sensor. Select measurement mode which enables the measurement of the maximal strength developed by the animal.

9.1.3 The unit of measurement of the sensor is delivered in grams mode (by default).

9.1.4 Reset the display on the sensor to zero.

9.2 **Animal handling:**

9.2.1 Prepare a record sheet to include the details of the mouse identification.

9.2.2 Remove a mouse from its home cage, gripping the base of the tail between the thumb and the forefinger

thumb and the forefinger.

9.2.3 **Forelimb measurement:** Gently lower the mouse over the top of the grid so that only its *front* paws can grip the grid. Allow the mouse to attach to the grid properly before pulling it away. Keep the torso horizontal and pull the mouse back steadily and horizontally (not jerking) until the grip is released down the complete length of the grid. When the animal releases the grid, the maximal grip strength value of the animal is displayed on the screen. Record the value manually or automatically as appropriate. Repeat this procedure to obtain a further 2 forelimb grip strength measurements

9.2.4 **Forelimb and hind limb measurement:** Gently lower the mouse over the top of the grid so that *both* its front paws and hind paws can grip the grid. Allow the mouse to attach to the grid properly before pulling it away. Keep the torso parallel to the grid and pull the mouse back steadily and horizontally (not jerking) until the grip is released down the complete length of the grid. Record the value manually or automatically as appropriate. Repeat this procedure to obtain a further 2 forelimb and hind limb grip strength measurements

9.3 At the end of the testing session, weigh the animal .

9.4 Make a note of any observations made during the test (e.g. mice fail to grip etc.).

9.5 Clean the grid with 50% ethanol and dry with tissue, before testing each cage of mice.

10.0 Data Records and Reports:

10.1 Parameters recorded:
Forelimb grip strength measurement-t1
Forelimb grip strength measurement-t2
Forelimb grip strength measurement-t3
Forelimb and hind limb grip strength measurement-t1
Forelimb and hind limb grip strength measurement-t2
Forelimb and hind limb grip strength measurement-t3
Body weight
Any other observation

Any other observation

10.2 Derived data:

Forelimb grip strength measurement-mean
Forelimb grip strength mean ratio to body weight
Forelimb and hind limb grip strength measurement-mean
Forelimb and hind limb grip strength mean ratio to body weight

11.0 Supporting information:

11.1 Ashton, L.A. & Myers S. Serial grip strength testing-its role in assessment of wrist and hand disability. (2004) *Internet J Surg*, 5 (2).

11.2 Grubb SC, Churchill GA, Bogue MA. (2004). A collaborative database of inbred mouse strain characteristics. Bioinformatics, 20: 2857-9.

11.3 Meyer, O.A., Tilson, H.A., Byrd, W.C. & Riley, M.T. (1979) A method for the routine assessment of fore- and hindlimb grip strength of rats and mice. *Neurobehav Toxicol.* 1 (3), 233-6.

11.4 Maurissen JP, Marable BR, Andrus AK, Stebbins KE. (2003). Factors affecting grip strength testing. Neurotoxicol Teratol. 25(5):543-53.

11.5 van Riezen, H. & Boersma, L. (1969) A new method for quantitative grip strength evaluation. *Eur J Pharmacol.*6 (3), 353-6.

12.0 History review:

12.1 The number of trials is reduced to 3 trials for each of the forelimb and combined forelimb/hind limb measurements (instead of 5 trials in the SOP document 10_003, Rev No 0, date issued 01/06/04).

13.0 Emergency Procedures:

Parameters and Metadata

Forelimb grip strength measurement ESLIM_009_001_001 | v1.0

seriesParameter

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

Unit Measured: g

Description: Forelimb_grip_strength_measurement

Increments: 1, 2, 3,

Forelimb and hindlimb grip strength measurement ESLIM_009_001_002 | v1.0

seriesParameter

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

Unit Measured: g

Description: Forelimb_and_hindlimb_grip_strength_measurement

Increments: 1, 2, 3,

Body weight ESLIM_009_001_003 | v1.0

simpleParameter

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

Unit Measured: g

Description: Body_weight

General comments about the mouse ESLIM_009_001_004 | v1.0

simpleParameter

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

Description: General_comments_about_the_mouse

Forelimb grip strength measurement mean ESLIM_009_001_701 | v1.0

simpleParameter

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

Unit Measured: g

Description: Forelimb_grip_strength_measurement_mean

Derivation:
archived('sum_of_increments(ESLIM_009_001_001)/number_of_increments (ESLIM_009_001_001)')

Forelimb and hindlimb grip strength measurement mean E

SLIM_009_001_702 | v1.0

simpleParameter

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

Unit Measured: g

Description: Forelimb_and_hind_limb_grip_strength_measurement_mean

Derivation:
archived('sum_of_increments(ESLIM_009_001_002)/number_of_increments (ESLIM_009_001_002)')

Forelimb grip strength normalised against body weight ES

LIM_009_001_703 | v1.0

simpleParameter

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

Description: Forelimb_grip_strength_normalised_against_body_weight

Derivation:
archived('(sum_of_increments(ESLIM_009_001_001)/number_of_increments (ESLIM_009_001_001))/ESLIM_009_001_003')

Forelimb and hindlimb grip strength normalised against body weight ESLIM_009_001_704 | v1.0

simpleParameter

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

Description: Forelimb_and_hind_limb_grip_strength_normalised_against_body_weight

Derivation:
archived('(sum_of_increments(ESLIM_009_001_002)/number_of_increments (ESLIM_009_001_002))/ESLIM_009_001_003')

Equipment name ESLIM_009_001_801 | v1.0

procedureMetadata

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

Description: Equipment_name

Equipment manufacturer ESLIM_009_001_802 | v1.0

procedureMetadata

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

Description: Equipment_manufacturer

Equipment model ESLIM_009_001_803 | v1.0

procedureMetadata

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

Description: Equipment_model

Grid model ESLIM_009_001_804 | v1.0

procedureMetadata

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

Description: Grid_model
