# Grip Strength HAS_GRS_002

## Purpose

The grip strength test is used to measure the neuromuscular function as maximal muscle strength of forelimbs and combined forelimbs and hind limbs. These are assessed by the grasping applied by the mouse on a grid that is connected to a sensor. Three trials are carried out in succession measuring forelimb-strength only, followed by three successive trials measuring the combined forelimb/hindlimb grip strength. All grip strength values obtained are normalized against mouse body weight.

Ontological description: MP:0001515 - abnormal grip strength.

## Experimental Design

Age of animal: 13 and 66 weeks.

Sexual dimorphism: Yes.

## Equipment

1. Grip strength meter apparatus
2. Balance

## Procedure

1. **Set up and use of grip strength meter:**

a. Check the connection of the sensor to the grid is firmly in place to prevent the grid from turning around.
b. Turn the sensor on and select peak mode, which will enable a measurement of the maximal strength exerted by the mouse – the default unit of force measured is delivered in grams. Do *not* apply loads greater than the nominal capacity of the force sensor at the risk of permanently damaging the strength gauge.
c. Reset the display sensor to zero.

2. **Grip strength force:**

a. Remove a mouse from its home cage, gripping the base of the tail between the thumb and the forefinger.
b. *Forelimb measurement:* Lower the mouse over the grid keeping the torso horizontal and allowing only its forepaws to attach to the grid before any measurements are taken. Gently pull the mouse back by its tail ensuring the mouse grips the top portion of the grid and the torso remains horizontal and record the maximal grip strength value of

the mouse that is displayed on the screen. Repeat this procedure twice more to obtain 3 forelimb grip strength measurements.

c. *Forelimb and hindlimb measurement:* Lower the mouse over the grid keeping the torso parallel with the grid and allow both its forepaws and hind paws to attach to the grid before any measurements are taken. Gently pull the mouse back by its tail ensuring the torso remains parallel with the grid and record the maximal grip strength value of the mouse that is displayed on the screen. Repeat this procedure twice more to obtain 3 forelimb/hindlimb grip strength measurements.
d. Place the mouse on the balance and record the weight of the mouse.
e. Make a note of any further observations found during the test e.g. failure to grip the grid.
f. Place the mouse back in its home cage.

3. Clean the grid with ethanol (50%) and allow time to dry before testing each cage of mice.

# Notes

Mice with missing digits (e.g. after toe clipping) should be omitted from this test. Behavioural parameters may be influenced by circadian rhythm therefore testing should be routinely carried out around the same time of day to obtain balanced and valid results. Avoid testing immediately after light-dark transition as behavioural outcome may be affected.

## Data QC

1. Calibrate the grip strength meter in accordance with the equipment guidelines.
2. The force sensor is fragile and should never be overloaded.

## Metadata and examples

| **Metadata** | **Example** |
|---|---|
| Equipment ID | ID of the machine used when more than 1 is used having same model and manufacturer. E.g. machine 1, machine 2, machine Minnie, machine Mickey Mouse, etc. |
| Equipment manufacturer | Manufacturer of the equipment. E.g. Bioseb. |
| Equipment model | Model of the equipment. E.g. BIO-GT3+MR |
| Grid model | Model of the grid. E.g. HMGU manufactured grid with only horizontal bars. |
| | |

| | |
|---|---|
| Experimenter ID | An ID of any format to be used coherently both inside the same procedure and for all procedures. E.g. Harw_001, or 1/2/3. |
| Date equipment last calibrated | Most recent date in which the equipment (or any part of) used in the procedure was subject to a calibration event. |

## Parameters and Metadata

### Forelimb grip strength measurement HAS_GRS_001_001 | v1.2

seriesParameter

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

**Unit Measured:** g

**Description:** forelimb_grip_strength_measurement

**Increments:** 1, 2, 3,

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### Forelimb and hindlimb grip strength measurement HAS_GRS_002_001 | v1.1

seriesParameter

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

**Unit Measured:** g

**Description:** forelimb_and_hindlimb_grip_strength_measurement

**Increments:** 1, 2, 3,

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## Body weight HAS_GRS_003_001 | v1.1

simpleParameter

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

**Unit Measured:** g

**Description:** body_weight

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## General comments about the mouse HAS_GRS_004_001 | v1.1

simpleParameter

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

**Description:** general_comments_about_the_mouse

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## Equipment ID HAS_GRS_005_001 | v1.0

procedureMetadata

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

**Description:** equipment_name

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## Equipment manufacturer HAS_GRS_006_001 | v1.0

procedureMetadata

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

**Description:** equipment_manufacturer

**Options:** Chatillon, Bioseb,

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## Grid model HAS_GRS_007_001 | v1.0

procedureMetadata

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

**Description:** grid_model

**Options:** HMGU plate, Not HMGU plate,

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## Forelimb grip strength measurement mean HAS_GRS_008_001 | v1.3

simpleParameter

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

**Description:** forelimb_grip_strength_measurement_mean

**Derivation:**
archived('sum_of_increments(Forelimb grip strength measurement)/number_of_increments (Forelimb grip strength measurement)')

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## Forelimb and hindlimb grip strength measurement mean HAS_GRS_009_001 | v1.0

simpleParameter

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

**Unit Measured:** g

**Description:** forelimb_and_hindlimb_grip_strength_measurement_mean

**Derivation:**
archived('sum_of_increments(Forelimb and hindlimb grip strength measurement)/number_of_increments(Forelimb and hindlimb grip strength measurement)')

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## Forelimb grip strength normalised against body weight HAS_GRS_010_001 | 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(Forelimb grip strength measurement)/number_of_increments(Forelimb grip strength measurement))/Body Weight')

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## Forelimb and hindlimb grip strength normalised against body weight HAS_GRS_011_001 | v1.0

simpleParameter

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

**Description:** forelimb_and_hindlimb_grip_strength_normalised_against_body_weight

**Derivation:**
archived('(sum_of_increments(Forelimb and hindlimb grip strength measurement)
/number_of_increments(Forelimb and hindlimb grip strength measurement))/Body Weight')

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## PIL number HAS_GRS_012_001 | v1.1

procedureMetadata

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

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## Equipment model HAS_GRS_013_001 | v1.0

procedureMetadata

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

**Options:** Ametek, Bio-GT3+MR, Bio-GS3, Bio-GS2,

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## Date of procedure HAS_GRS_014_001 | v1.4

simpleParameter

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

## Procedural comments HAS_GRS_015_001 | v1.0

simpleParameter

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