evaluating the possibility of animals anoxiados present differences in somatic and ontogenetic patterns.

Neonatal anoxia in rats: evaluation of somatic and sensory-motor development

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Introduction

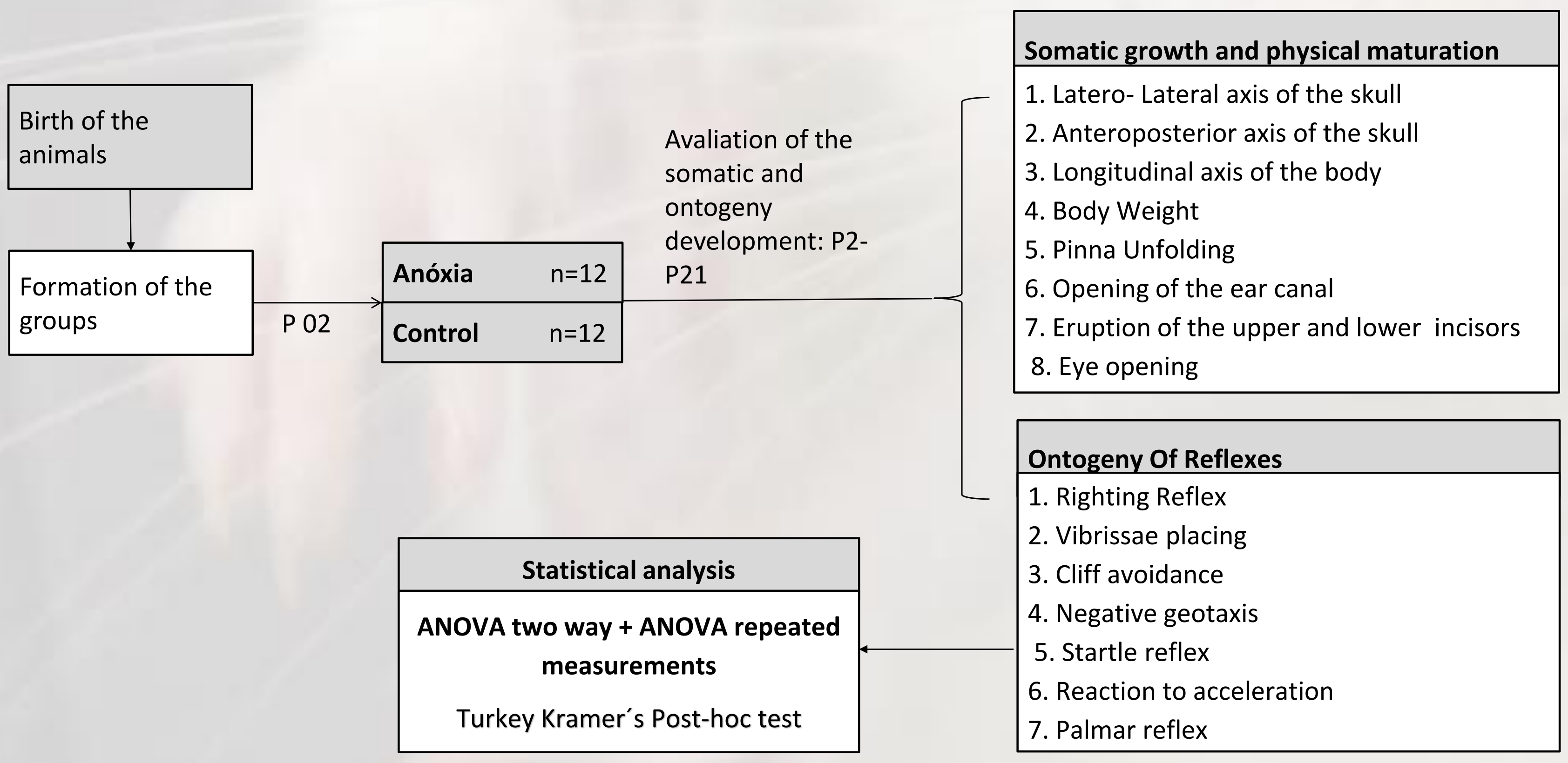
The neonatal anoxia, characterized by a significant reduction in the availability of oxygen during birth, is one of major causes of infant mortality and the emergence of lasting neurological sequeals including cerebral palsy, epilepsy, learning disabilities, hyperactivity, cognitive and sensorimotor deficits, among others. Previous studies have identified its deleterious effects on glial and neuronal populations of the hippocampal formation, neuronal death by apoptosis and necrosis, neurogenesis and volume changes in the hippocampus, loss to learning and spatial navigation of the animal, among other behavioral sequelae.

Objective

The present study investigated whether Neonatal Anoxia impacts somatic and sensory motor development in male rats, evaluating the possibility of the animals present changes in somatic and ontogenetic patterns between groups.

Material and Methods

Wistar rats 30 hours old (6-8 grams), male, was exposed for 25 minutes to 100% nitrogen gas flow of 3L/min, pressure 101.7 kPa at a temperature between 35 and 37°C in a semi-hermetic chamber polycarbonate. After 25 minutes animals were taken out from the chamber, and returned to the cages with their mothers, where they remained until P21. Their physical and somatic growth and ontogenesis of reflexes was daily evaluated. A control group of animals were subjected to the same experimental conditions but the chamber was opened to atmospheric air rather than nitrogen stream.



Birth of the animals

Formation of the groups

P 02

Anóxia	n=12
Control	n=12

Avaliation of the somatic and ontogeny development: P2-P21

Somatic growth and physical maturation

1. Latero- Lateral axis of the skull
2. Anteroposterior axis of the skull
3. Longitudinal axis of the body
4. Body Weight
5. Pinna Unfolding
6. Opening of the ear canal
7. Eruption of the upper and lower incisors
8. Eye opening

Ontogeny Of Reflexes

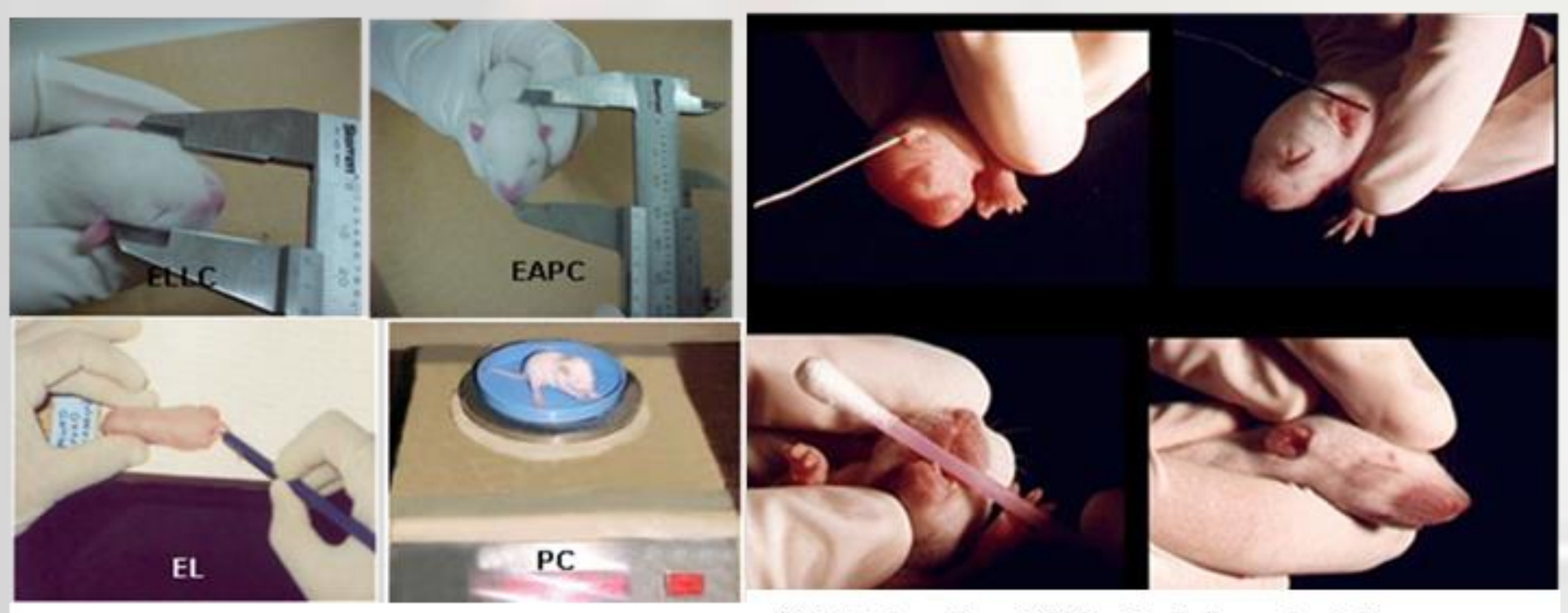
1. Righting Reflex
2. Vibrissae placing
3. Cliff avoidance
4. Negative geotaxis
5. Startle reflex
6. Reaction to acceleration
7. Palmar reflex

Statistical analysis

ANOVA two way + ANOVA repeated measurements

Turkey Kramer´s Post-hoc test

Figure 1. Schematic representation of experimental design



3.1 Somatic growth is measured from P2-P21
3.1.a Latero Lateral axis Of the Skull
3.1.b Anteroposterior axis of the skull
3.1.c Longitudinal axis of the body
3.1,d Body Weight

3.2 Maturation Of Physical characteristics
3.2.a Pinna Unfolding
3.2.b Opening Of The ear canal
3.2.c Eruption of the upper incisor
3.2.d Eruption of the lower incisor

3.3 Ontogeny of Reflexes P4 –P21

3.3.a Righting Reflex

3.3.b Vibrissae Placing

3.3.c Cliff Avoidance

3.3.d Negative Geotaxis

3.3.e Acoustic Startle

3.3.f Reaction to acceleration

Figure 3. The evaluation of somatic growth is done with the use of Vernier callipre for lengths and digital balance for weight.Physical Characteristics is marked positive once parameters used are matured.,and is expressed in Days. Ontogeny Of reflexes is evaluated on selected parameters (pictures taken by Antonio de Pádua Pombo de Barros; Vasconcelos et al., 2013)

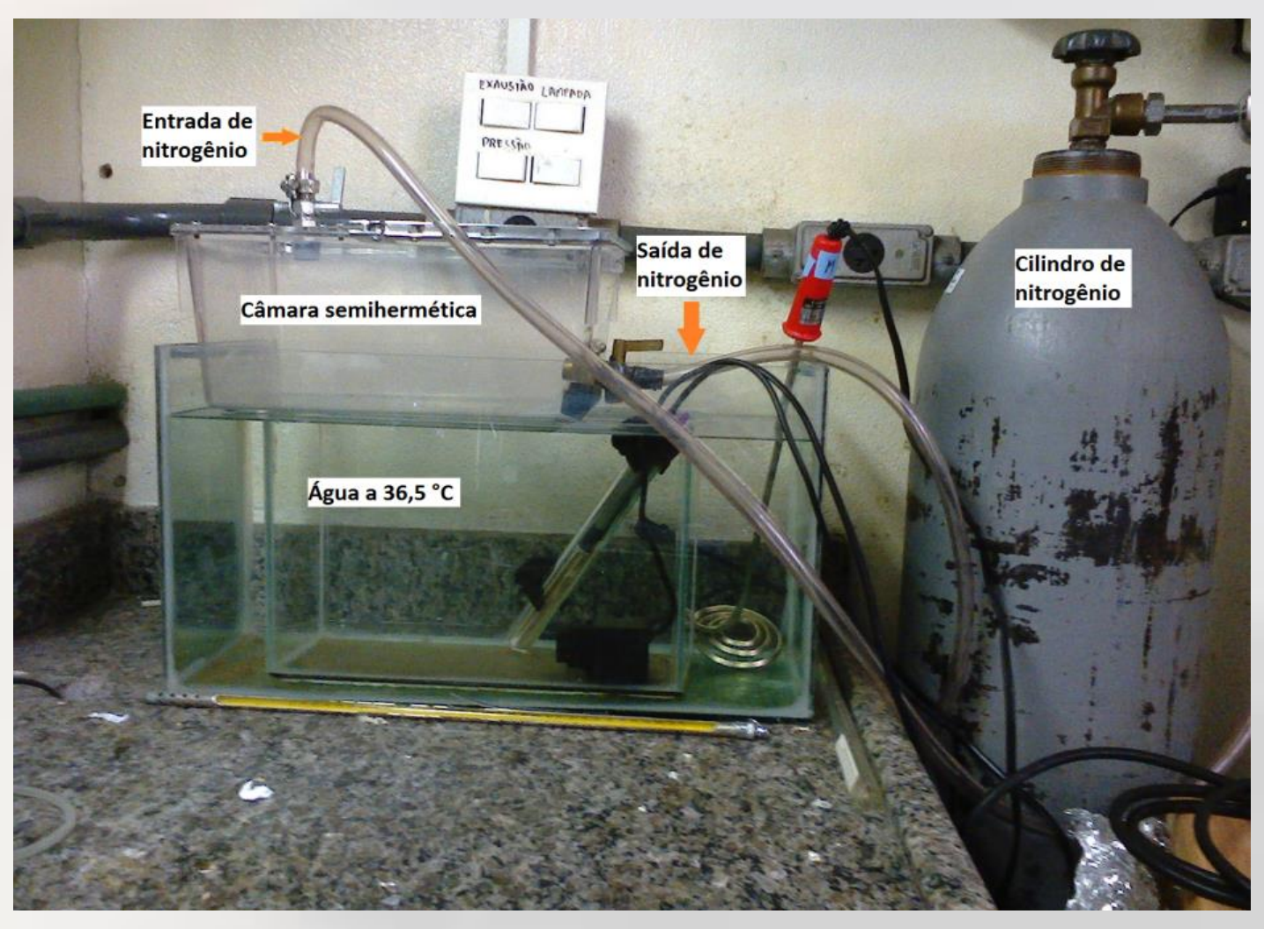


Figure 2. Used system for promoting neonatal anóxia (Takada et al., 2009; Lee, 2015).

Results

	Control Male	Anoxia Male	Group
Latero lateral axis of the skull (cm)	2,06 ± 0,04	2,04 ± 0,05	p < 0,05
Anteroposterior axis of the skull (cm)	3,17 ± 0,04	3,27 ± 0,05	p < 0,05
Longitudinal axis of the body (cm)	7,35 ± 0,10	7,47 ± 0,11	p < 0,05
Body weight (g)	20,13 ± 0,66	22,49 ± 0,75	p < 0,05

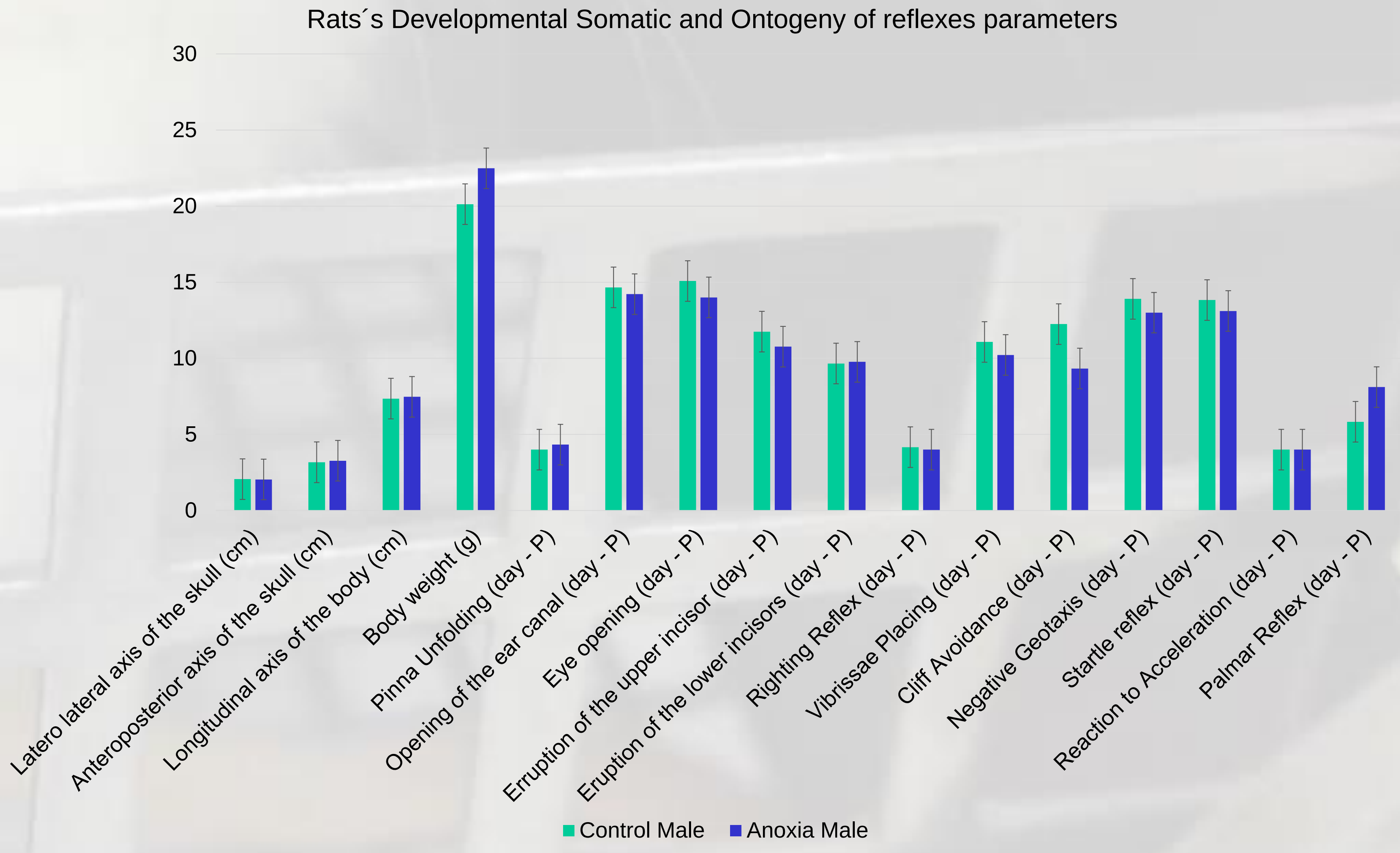
Table 1. Somatic development parameters measured between P2 and P21 (Mean ± SE).

	Control Male	Anoxia Male	Group
Pinna Unfolding (day – P)	4,00 ± 0,01	4,33 ± 0,16	p < 0,05
Opening of the ear canal (day – P)	14,66 ± 0,14	14,22 ± 0,22	p < 0,05
Eye opening (day – P)	15,08 ± 0,39	14,00 ± 37	p < 0,05
Erruption of the upper incisor (day – P)	11,75 ± 0,49	10,77 ± 0,22	p < 0,05
Eruption of the lower incisors (day – P)	9,66 ± 0,22	9,77 ± 0,40	p < 0,05
Righting Reflex (day – P)	4,16 ± 0,11	4,00 ± 0,00	p < 0,05
Vibrissae Placing (day – P)	11,08 ± 0,14	10,22 ± 0,43	p < 0,05
Cliff Avoidance (day – P)	12,25 ± 0,75	9,33 ± 0,28	p < 0,05
Negative Geotaxis (day – P)	13,91 ± 0,83	13,00 ± 0,78	p < 0,05
Startle reflex (day – P)	13,83 ± 0,50	13,11 ± 0,35	p < 0,05
Reaction to Acceleration (day – P)	4,00 ± 0,00	4,00 ± 0,00	p < 0,05
Palmar Reflex (day – P)	5,83 ± 0,56	8,11 ± 0,96	p < 0,05

Table 2. Onset day of parameters of somatic and sensorimotor development (Mean ± SE).

The results showed that animals submitted to anoxia showed, compared to the control, present significant delay in the appearance of the ear canal opening (control: 14 ± 0.01; anoxia: 14.83 ± 0.40), in the upper- and lower incisors outburst (control: 9.75 ± 0.16; anoxia: 10.66 ± 0.42) (Control: 9.62 ± 0.26; anoxia: 10.66 ± 0.42) and in the maturation Of the negative geotaxis ontogenetic reflexes (control: 9.75 ± 0.31; anoxia: 12 ± 0.96). In addition, the anoxic animals exhibited an advance in the onset of placing vibrissae (control: 10.87 ± 0.35; anoxia: 9.16 ± 0.70). Skull morphometric measurements of the body, body weight, opening eyes and pinna and decubitus recovery reflexes, cliff avoidance, response to shock, acceleration and palmar pressure were also evaluated, but no significant.

Difference was observed. The delay in the negative geotaxis reflexes during puerile phase indicates a non-functional integrity of motor and muscular system which might impair locomotion later.



Conclusions

Neonatal anoxia in rats exerted damaging effects on the development of their morphofunctional characteristics, and on the sensory-motor and on the onset of some ontogenetic reflex parameters of the rats which lasted until weaning. The causes require more investigation which are in course at our laboratory.

To understand the implication of oxygen deprivation on developing brain in terms of white matter damage and also to evaluate of maturation of sensorimotor system, physical development and onset of reflexes we need more investigation. Use of neuroprotection to work as therapy at the right brain developmental stage.