Options for harmonization of husbandry – a global perspective

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Committed to health research and alternatives

Harmonization ≠ Standardization

b. Additional provisions for housing and care of marmosets and tamarins

1. Introduction

Marmosets (*Callithrix spp.*) are small, highly arboreal, South American diurnal non-human primates. In the wild they have home ranges of 1 to 4 hectares where they live in extended family groups of three to fifteen animals consisting of a breeding pair and their offspring. Females produce litters twice a year (normally twins and in captivity, not infrequently, triplets) and all group members take care of the offspring. Reproductive inhibition of the subordinate females by the dominant occurs due to hormonal and behavioural mechanisms. Marmosets are frugivore-insectivore and are specialised in gum-tree gouging and gum feeding; however, in captivity they would gouge and scent-mark other hardwoods. Foraging and feeding occupy up to 50% of the time available. Marmosets and tamarins can live for up to fifteen to twenty years in captivity.

Tamarins (*Saguinus spp.*) are similar to marmosets in many respects. They are found in South and Central America, but are slightly larger animals and have larger home ranges, varying from 30 to 100 hectares. The larger home ranges of tamarins are related to more frugivorous diets, while they do not gouge, and eat gum only when readily accessible.

Most marmosets and tamarins show reluctance to descend to the ground and frequently scent-mark their environment.

2. The environment and its control

2.1. Ventilation

(See paragraph 2.1. of the General section)

2.2. Temperature

Marmosets and tamarins should be maintained in a temperature range of 23°C to 28°C, although levels slightly higher are acceptabl e due to the tropical nature of the animals.

2.3. Humidity

Humidity levels of 40 to 70% should be provided, although the animals will tolerate relative humidity levels higher than 70%.

2.4. Lighting

A photoperiod of no less than twelve hours of light is recommended. The lighting source should illuminate uniformly the holding room. However, within the animal enclosures, a shaded area should always be provided.

2.5. Noise

Special consideration should be given to minimise exposure to ultra-sound, which is within the hearing range of marmosets and tamarins.

2.6. Alarm system

(See paragraph 2.6. of the General considerations for non-human primates)

3. Health

(See paragraph 3 of the General considerations for non-human primates)

4. Housing, enrichment and care

4.1. Housing

Marmosets and tamarins should be housed in family groups consisting of unrelated male-female pairs and one or more sets of offspring. Groups of stock animals should consist of compatible same-sex peer individuals or juveniles. Care should be taken when grouping unrelated adult individuals of the same sex since overt aggression may occur.

During experiments, marmosets and tamarins can generally be kept with a compatible same-sex animal (twins, parent/offspring) or in male-female pairs, using contraception. When experimental procedures or veterinary care require single housing, the duration should be minimised and the animals should remain in visual, auditory and olfactory contact with conspecifics.

Breeding pairs should be formed only when the animals are aged about 2 years. In family groups, the presence of the mother will inhibit the ovulatory cycle in her female offspring. New pairs intended for breeding should not be kept close to the parental family since reproduction may be inhibited.

The appropriate age of weaning will depend on the intended use of the animals but should not be earlier than 8 months of age. When animals are to be used as breeders, they should remain in the family group until at least 13 months of age in order to acquire adequate rearing experience.

4.2. Enrichment

The natural behaviour of marmosets and tamarins indicates that the captive environment should provide some degree of complexity and stimulation, factors which are more valuable than simply increasing enclosure dimensions to promote species-typical behaviour. Furniture of natural or artificial materials (for example, wood, PVC) should include: perches, platforms, swings, ropes. It is important to provide a certain degree of variability in orientation, diameter and firmness to allow the animals to perform appropriate locomotor and jumping behaviours. Wooden perches allow marmosets and tamarins to express their natural behaviour of gnawing followed by scent-marking. In addition, a comfortable secure resting area such as nest boxes should be included since they are used for resting, sleeping and hiding in alarming situations. Though visual contact between family groups is normally stimulating for the animals, opaque screens and/or increasing the distance between enclosures in order to avoid territorial interaction may be needed in some cases, and in particular for certain callitrichid species. Foraging devices, which stimulate the natural behaviour of the animals, should be suspended or presented in the upper part of the enclosure, in consideration of the reluctance of the animals to descend to ground level. Wood chips as a substrate will encourage foraging of spilled food at the floor area. In general, the inclusion in the lower part of the enclosure of structural elements and enrichment devices will promote a wider and more diversified use of the space. For marmosets, which are specialised in tree-gnawing to obtain gum, sections of dowel drilled with holes and filled with gum arabic have proved very beneficial.

4.3. Enclosures – dimensions and flooring

For marmosets and tamarins the volume of available space and the vertical height of the enclosure are more important than floor area, due to the arboreal nature and the vertical flight reaction of these species. The minimum dimensions and design of the enclosure should take into account the purpose for which the animals are maintained (breeding, stock, short or long experiments) and enable the inclusion of sufficient devices for improving the environmental complexity.

Table F.1. Marmosets and Tamarins: Minimum enclosure dimensions and space allowances

	Minimum floor area of enclosures for 1* or 2 animals plus offspring up to 5 months old (m^2)	Minimum volume per additional animal over 5 months (m^3)	Minimum enclosure height (m) **
Marmosets	0.5	0.2	1.5
Tamarins	1.5	0.2	1.5

* Animals should only be kept singly under exceptional circumstances (see paragraph 4.1).
** The top of the enclosure should be at least 1.8m from the floor.

4.4. Feeding

Marmosets and tamarins require a high protein intake and since they are unable to synthesise vitamin D_3 without access to UV-B radiation, the diet must be supplemented with adequate levels of vitamin D_3.

4.5. Watering

(See paragraph 4.7. of the General section)

4.6. Substrate, litter, bedding and nesting material

(See paragraph 4.6. of the General considerations for non-human primates)

4.7. Cleaning

Marmosets and tamarins frequently scent-mark their environment and the total removal of familiar scents may cause behavioural problems. Alternate cleaning and sanitation of the enclosure and the enrichment devices retains some of the territorial scent-marking and has beneficial effects on the psychological well-being of the animals, reducing over-stimulated scent-marking.

4.8. Handling

Regular handling and human contact are beneficial for improving the animals' habituation to monitoring and experimental conditions and facilitate training to co-operate with some procedures. When capture and transport of the animals are required, nest boxes can be used to reduce handling stress.

4.9. Humane killing

(See paragraph 4.11. of the General section)

4.10. Records

(See paragraph 4.10. of the General considerations for non-human primates)

4.11. Identification

(See paragraph 4.11. of the General considerations for non-human primates)

5. Training of personnel

(See paragraph 5 of the General considerations for non-human primates)

6. Transport

(See paragraph 6 of the General considerations for non-human primates)

Old housing conditions

New housing conditions

Cleaning & bedding

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ORIGINAL ARTICLE

Numerical chromosome disorders in the common marmoset (*Callithrix jacchus*) – comparison between two captive colonies

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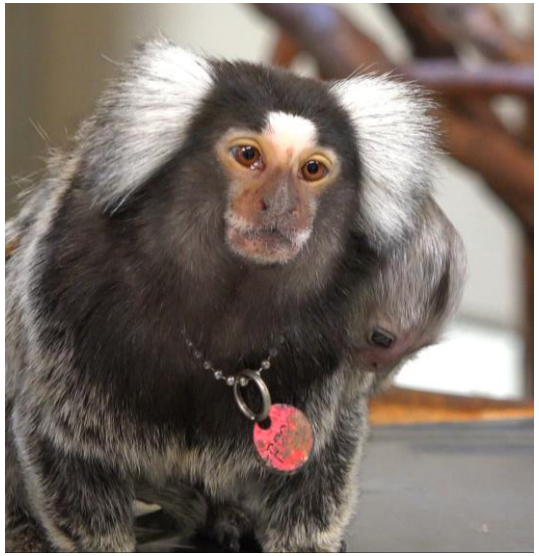
Abstract

Background Chromosomal analyses were performed for marmosets from two colonies – Deutsches Primatenzentrum (DPZ) and Biomedical Primate Research Centre (BPRC). Chlorine-based disinfectants are used in DPZ; no chemical disinfection is applied in BPRC.
Methods The rates of chromosomal non-disjunction, polyploidy and endoreduplication were investigated after G-banding.
Results For DPZ monkeys, the mean rates of non-disjunction were 7.6% for bone marrow and 11.3% for lymphocytes. The polyploidy level was 2.5% in bone marrow and 0.8% in blood. Frequency of endoreduplication in bone marrow and in leucocytes was 0.5% and 0.8%, respectively. For BPRC, the rate of non-disjunction in leucocytes (1.3%) was significantly lower than that for DPZ; the polyploidy rate (0.2%) in blood was lower than that in DPZ;

How to deal with triplets?



- Cross fostering
- Hand rearing
- ……

‘Hand-rearing techniques have serious adverse effects, as normal maternal and family relations are disturbed. The early experiences of marmosets are critical in influencing their development and ability to cope with later events, changes or other stressors’

Enrichment & diet

Do we need to create germ free or gnotobiont?

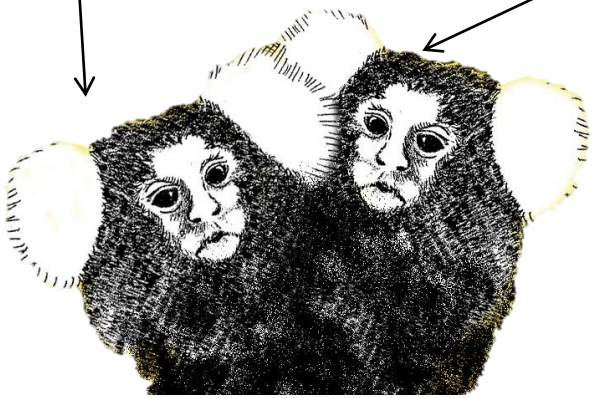
Research question: Can diet change the susceptibility to EAE?

8 weeks before rhMOG/IFA immunization -

> change to water-based diet

Water-based diet

Yogurt-based diet



8 twins

EAE score

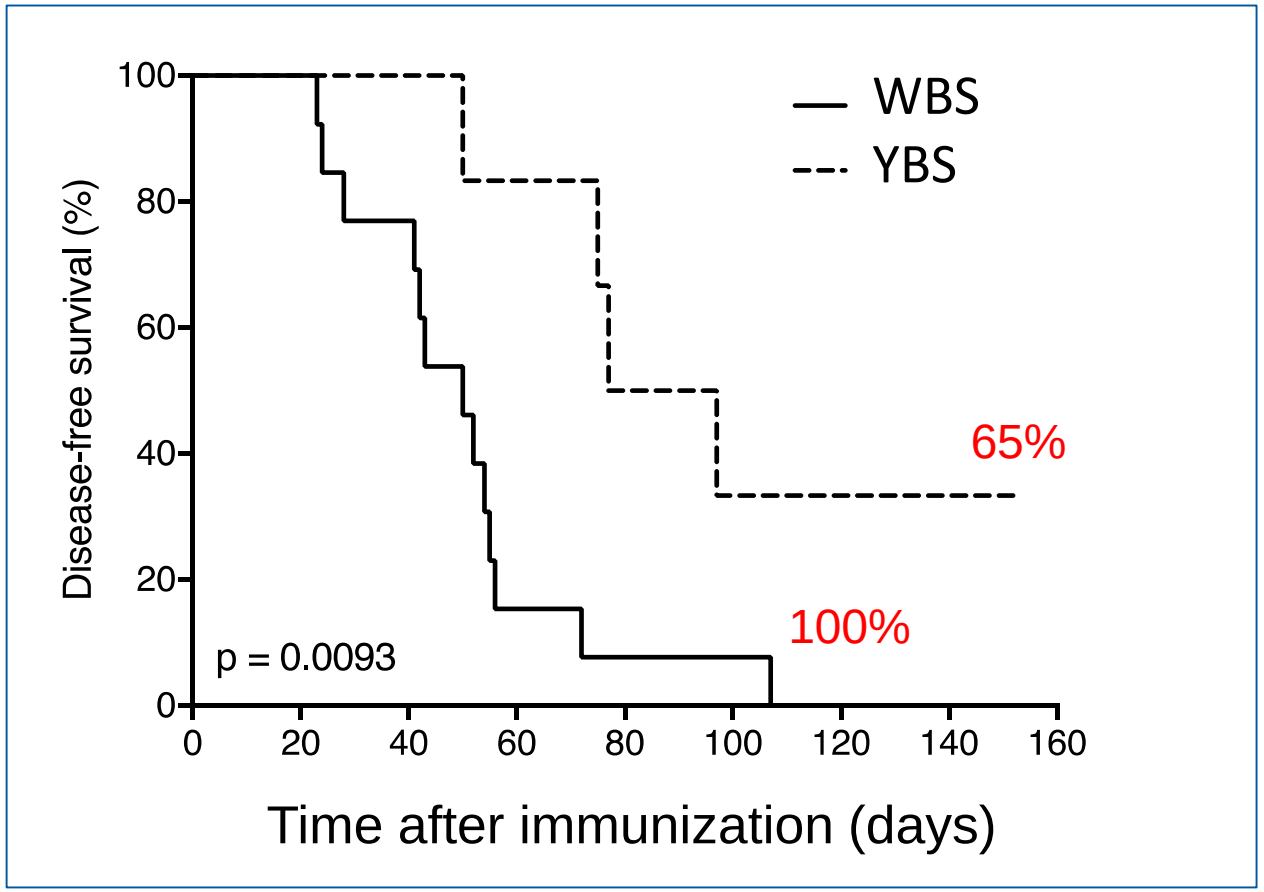
Pathology

Gene expression in the brain

Microbiota

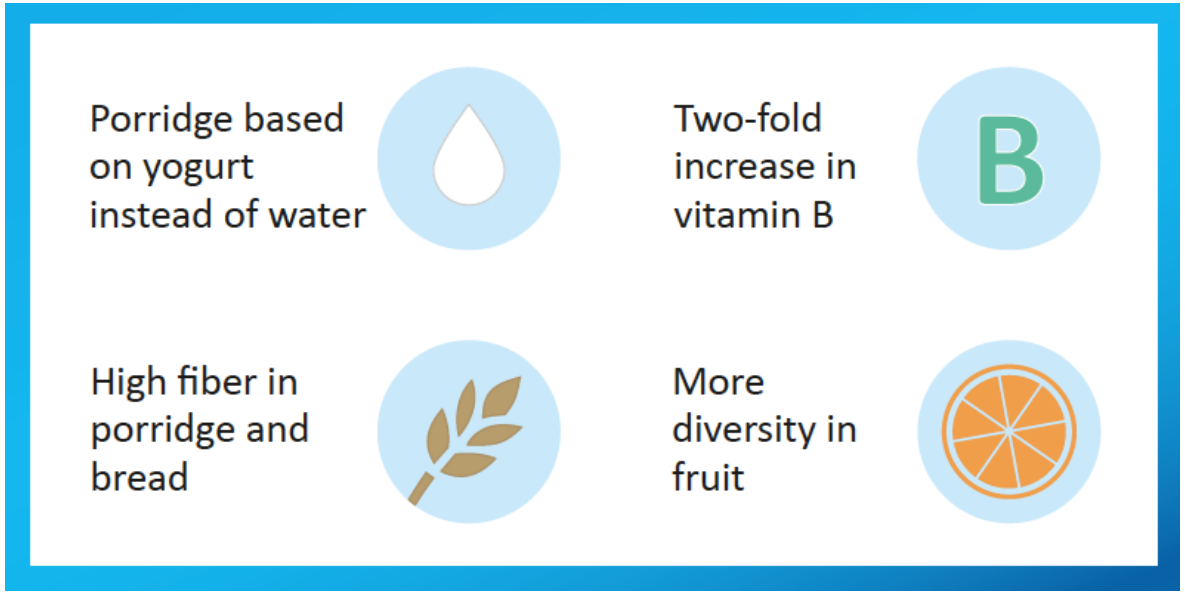
Immune response

A reduced incidence and delayed time to onset after diet change



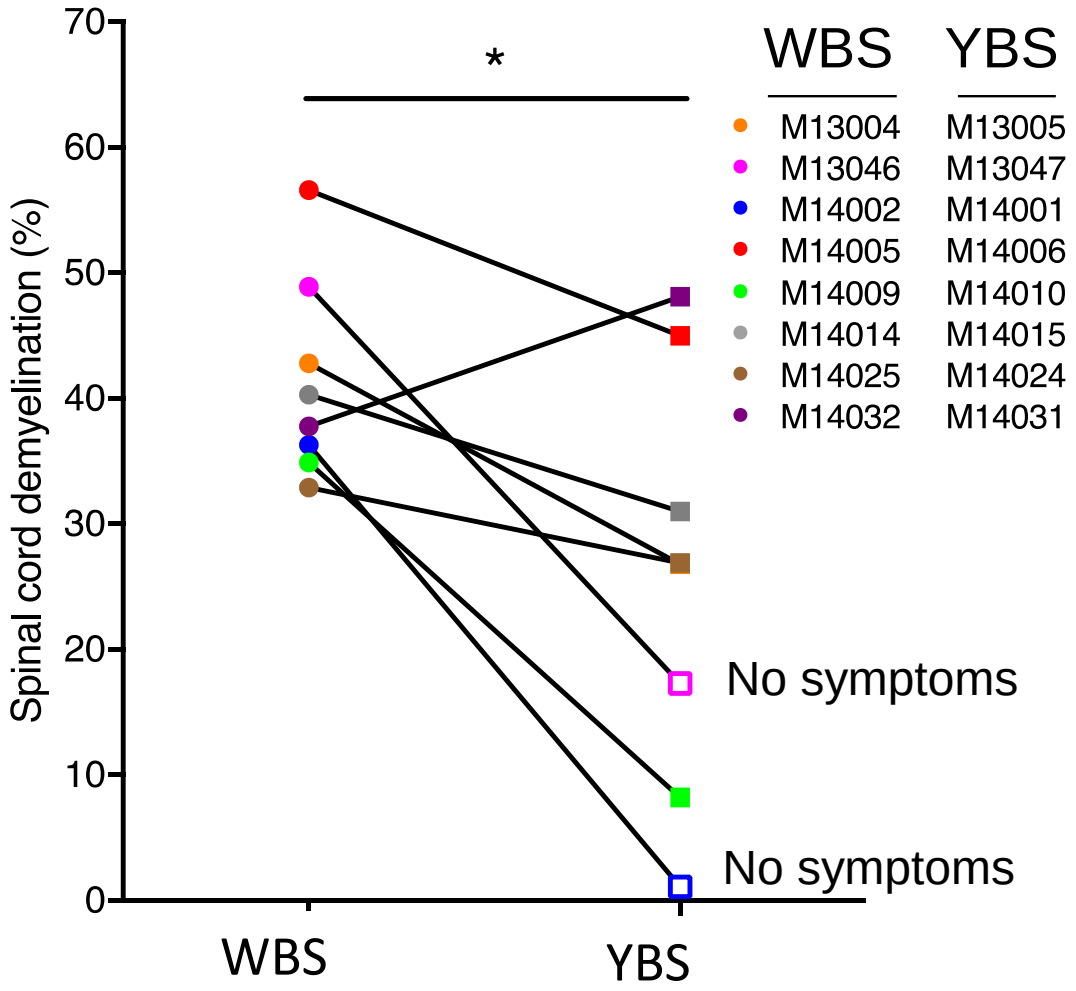
rhMOG/IFA

Yogurt-based vitamin B-enriched diet



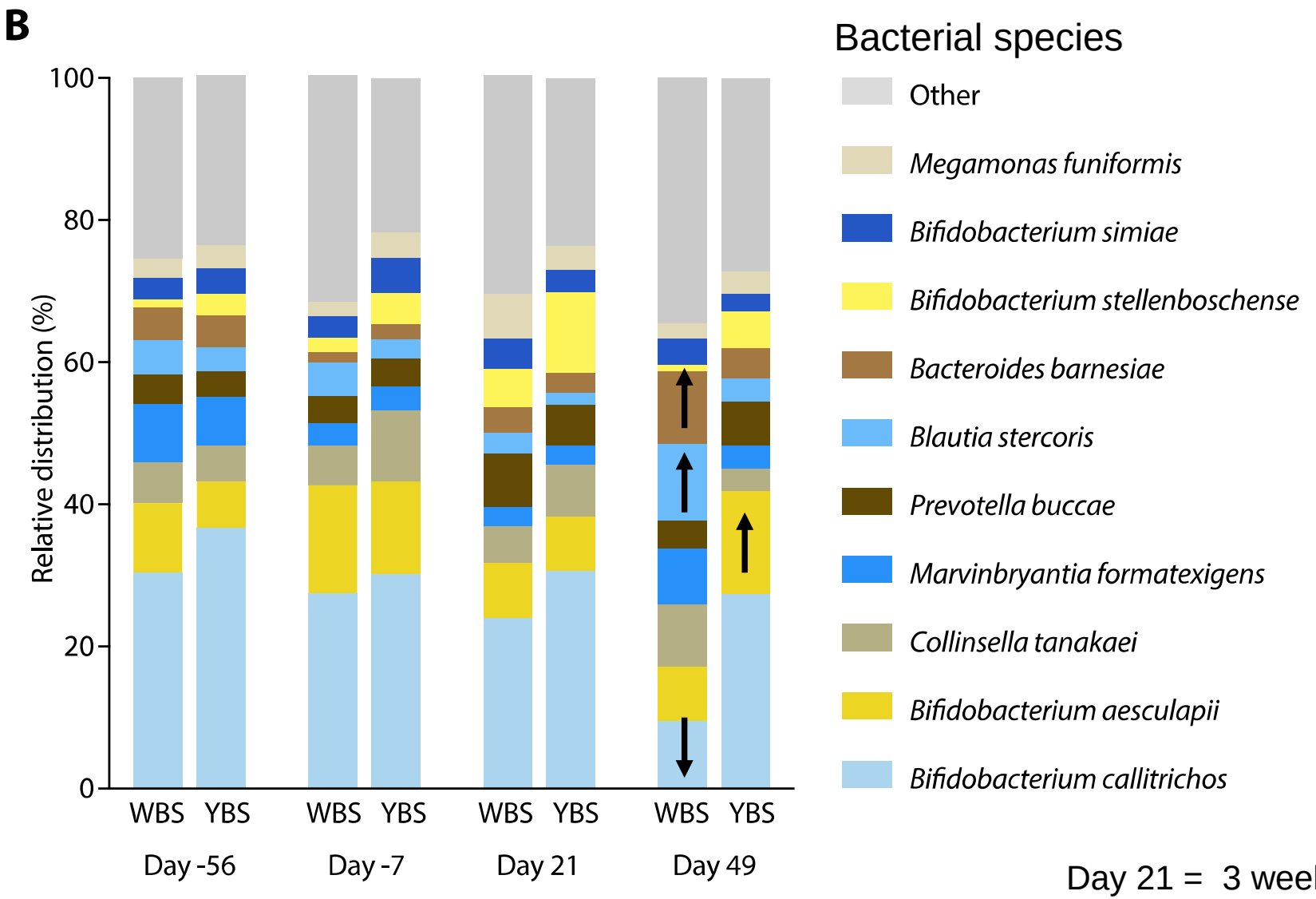
Yogurt-based diet (YBS)
Water-based diet (WBS)

Reduced spinal cord demyelination in the YBS diet



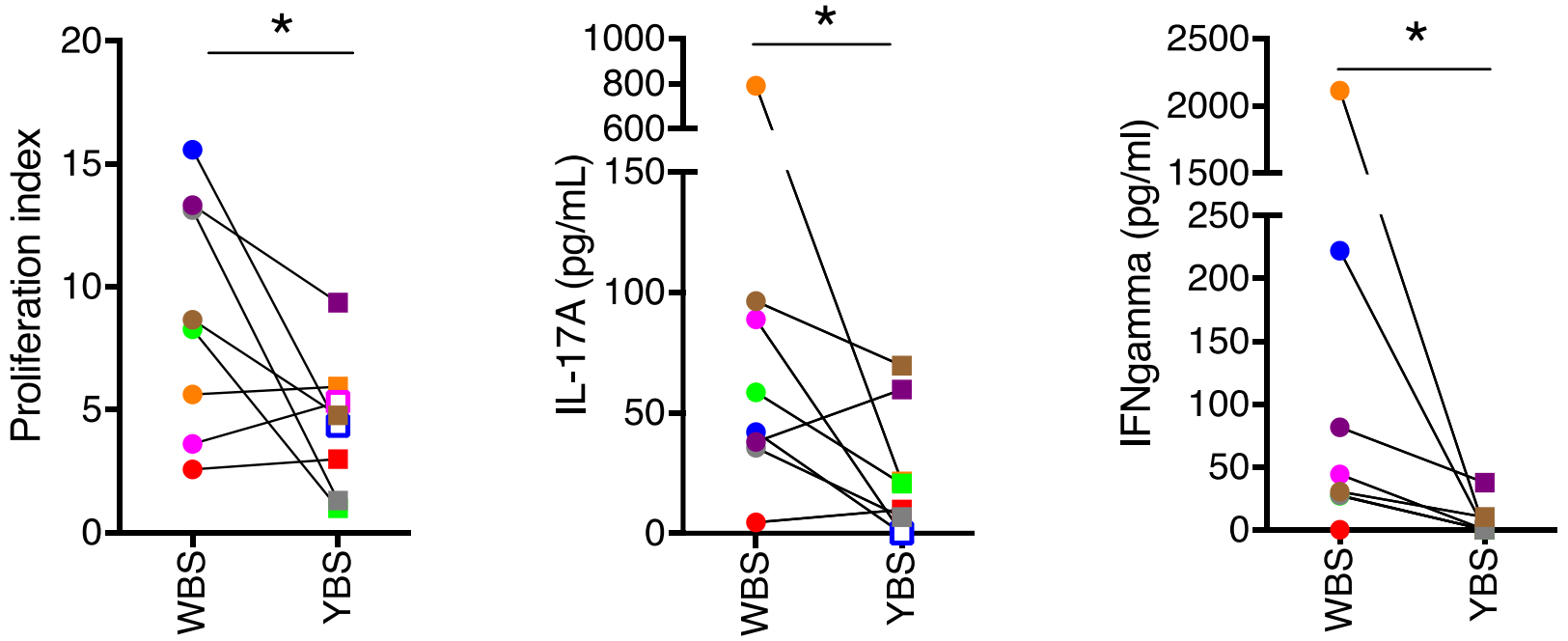
Yogurt-based diet (YBS)
Water-based diet (WBS)

Differences in microbiota started after immunization



Day 21 = 3 weeks after immunization
Day 49 = 7 week after immunization

The pro-inflammatory immune response was reduced in the YBS diet



Yogurt-based diet (YBS)
Water-based diet (WBS)

Key findings

The yogurt-based dietary supplement:

- Protected some animals against development of EAE
- Reduced MS-like pathology of the spinal cord
- Increased myelin-related gene expression in the brain
- Induced a divergence of gut microbiota from 3 weeks after EAE induction onward
- Reduced MOG-specific T-cell proliferation and pro-inflammatory cytokine production

Summarized

Immune system is influenced by various factors

- Age
- Bedding & cleaning
- Microbiome
- Catching & fixation
- Sedated versus non-sedated sampling