12° NEEX

SALA

# ENDURANCE SUMMIT 2024

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Laboratório de Imunometabolismo

# TREINAMENTO X IMUNIDADE: QUEBRANDO MITOS COM CIÊNCIA DO ENDURANCE

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# QUAL A RELAÇÃO ENTRE TREINAMENTO FÍSICO E EXERCÍCIO AGUDO COM A NOSSA IMUNIDADE?

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# POR QUE O EXERCÍCIO DE ENDURANCE AFETA MAIS O SISTEMA IMUNOLÓGICO?

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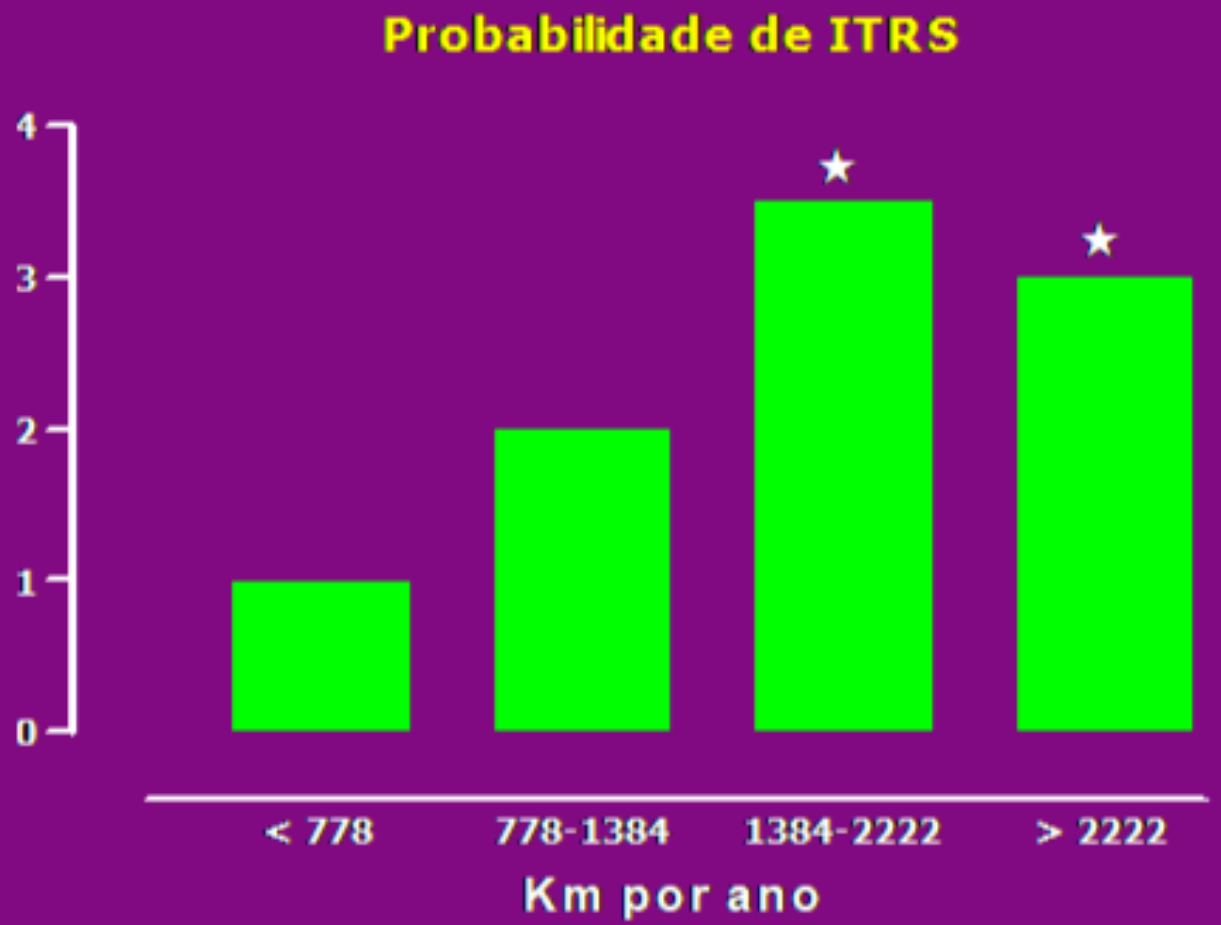
# HISTÓRIA DA IMUNOLOGIA DO EXERCÍCIO

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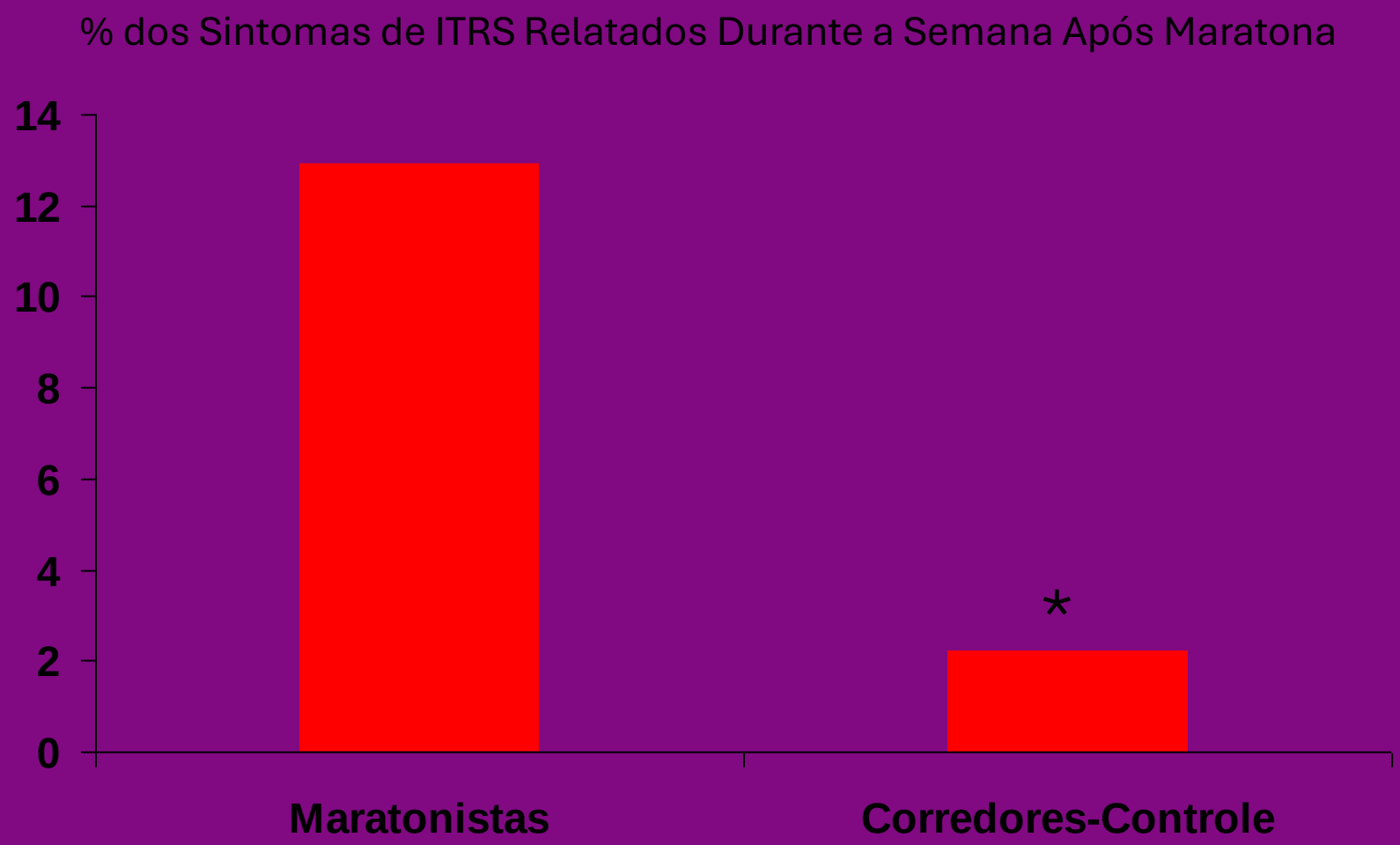
# Treinamento Moderado X ITRS

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Nieman et al., 1990

# COVID-19 EXERCÍCIO E FUNÇÃO AUTONÔMICA

## Impact of post-acute COVID-19 exercise training on cardiovascular autonomic function in amateur runners: A self-controlled longitudinal study

Xu, Shen[1]; Xian, Hong[2]; Liao, Yue[2]; Zhang, Haowei[3]; Xia, Ling[4]; Liu, Yixin[2]; Tong, Nanwei[1]

Editor(s): Li, Jinjiao

Author Information

*Chinese Medical Journal* ():10.1097/CM9.0000000000003251, September 05, 2024. | *DOI:* 10.1097/CM9.0000000000003251

load. Given the need for caution and close monitoring of cardiovascular autonomic function during exercise training after the acute phase of COVID-19, the mechanisms of CVAD post-acute COVID-19 and its response to exercise training require further exploration.

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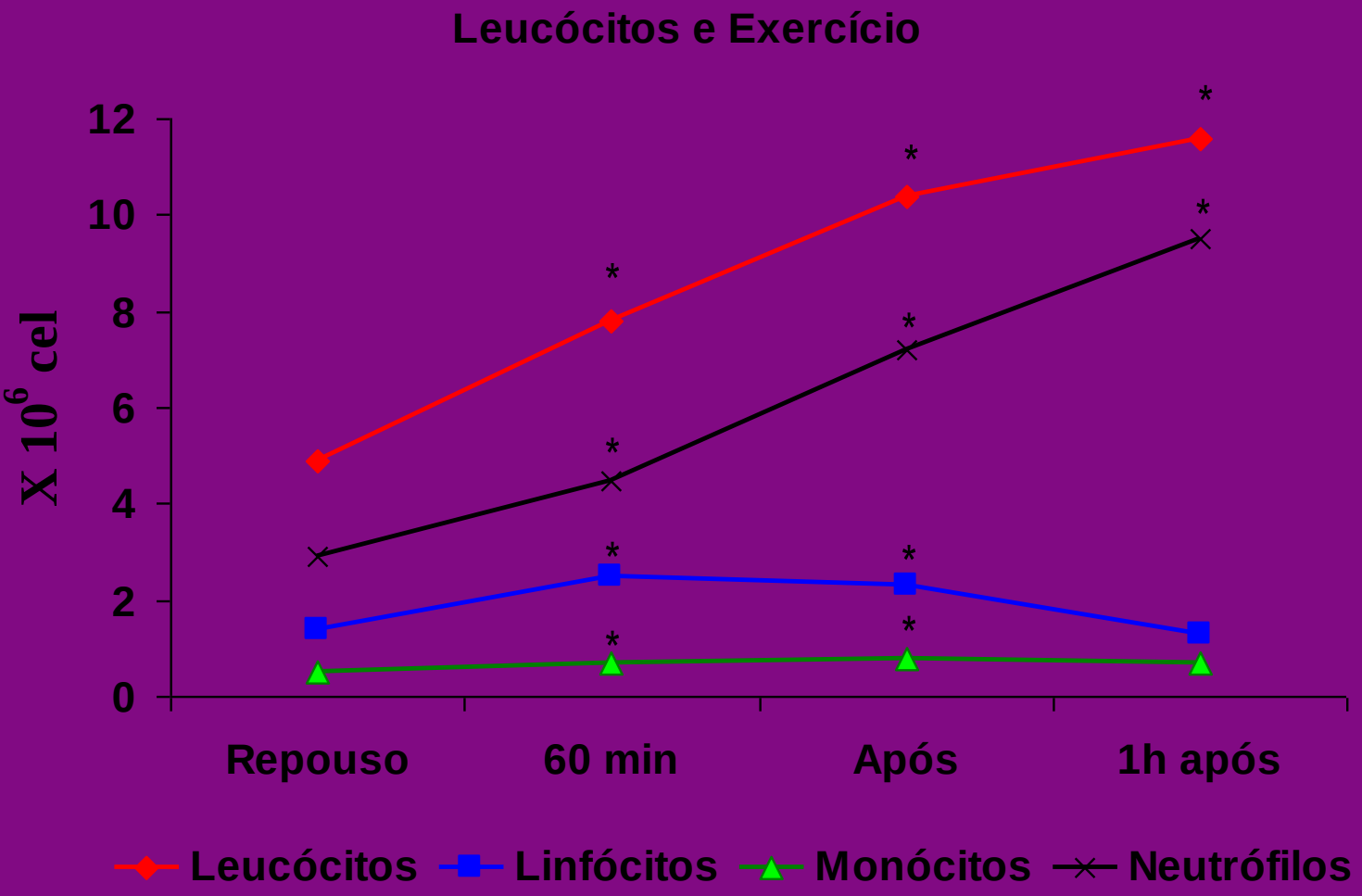
# RESPOSTA IMUNOLÓGICA APÓS O EXERCÍCIO AGUDO

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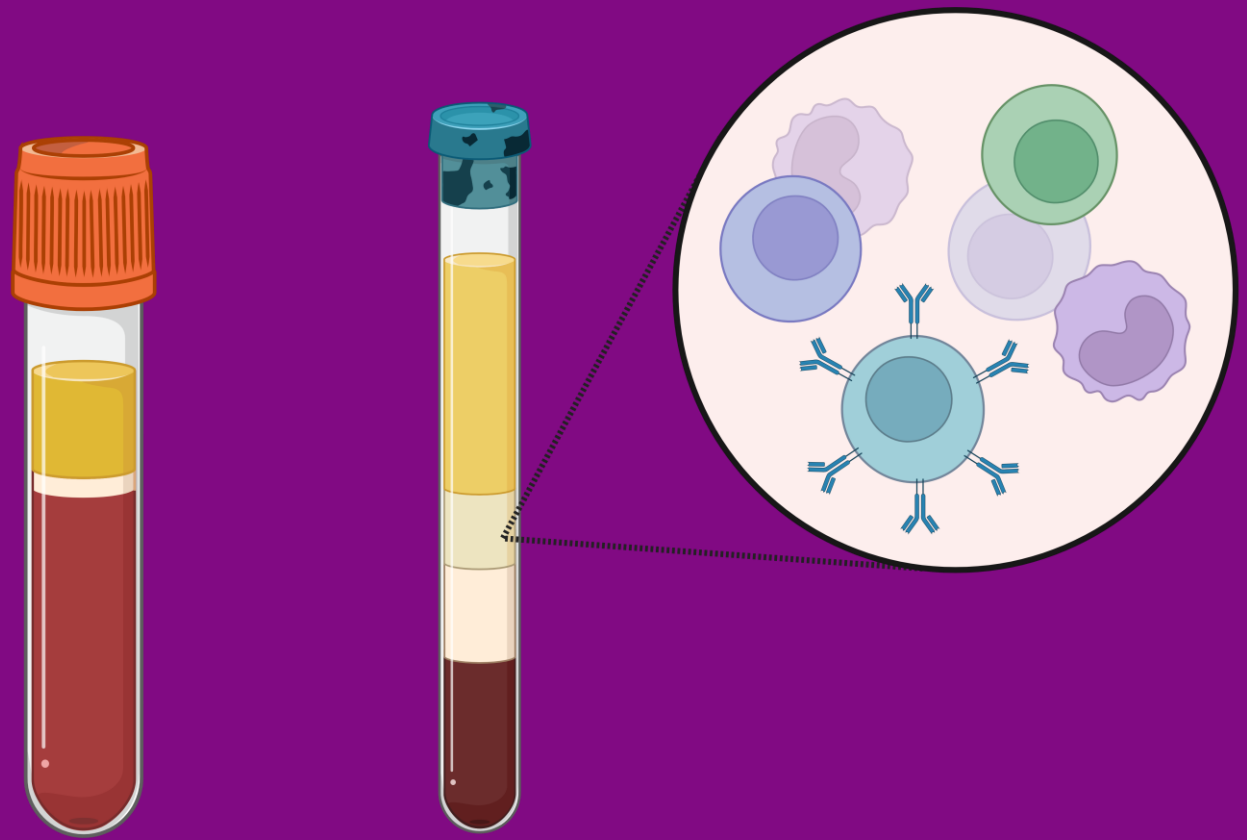
Lancaster et al., 2005

# LEUCOGRAMA



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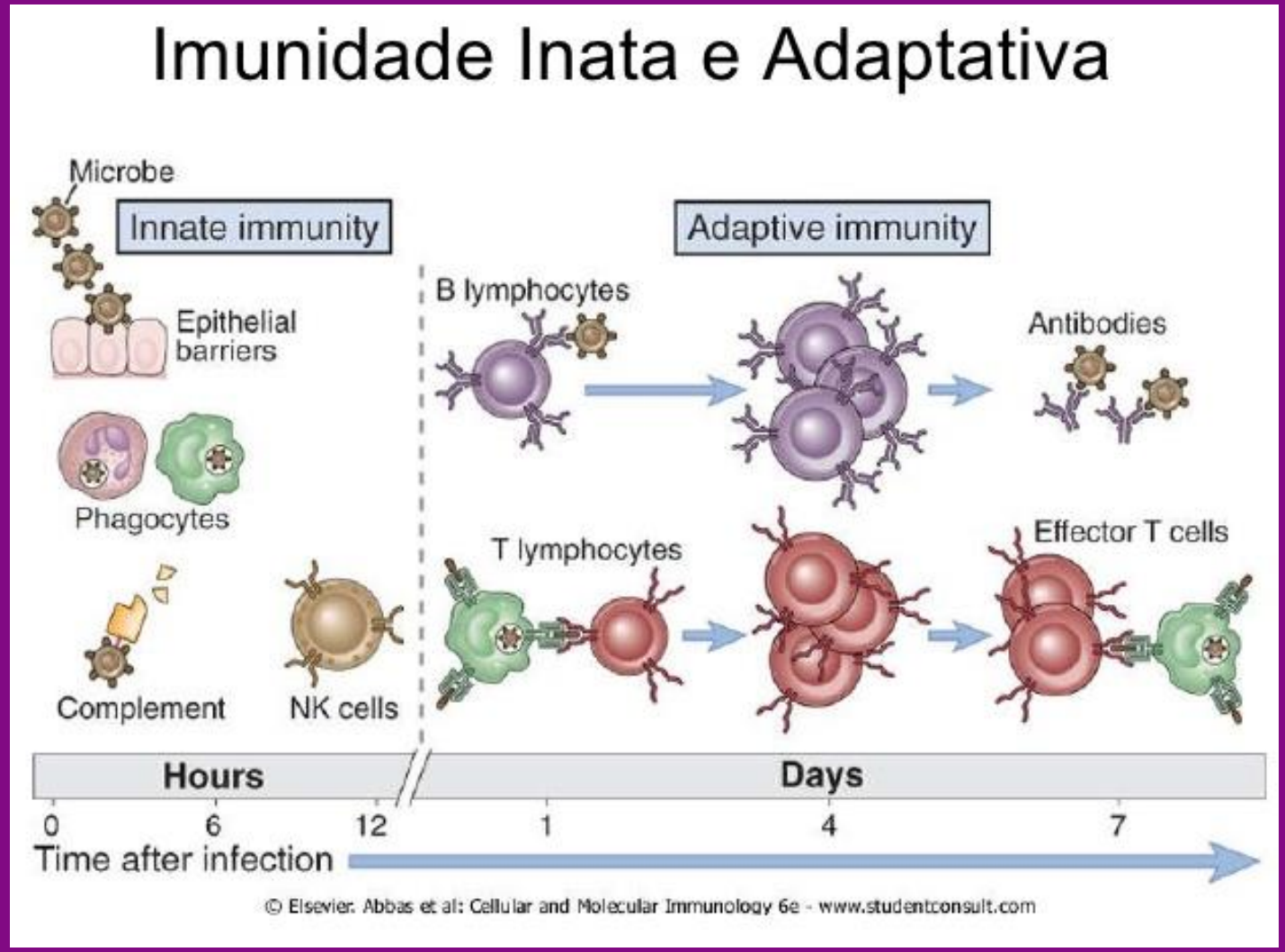
# RESPOSTA IMUNOLÓGICA

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# RESPOSTA IMUNOLÓGICA


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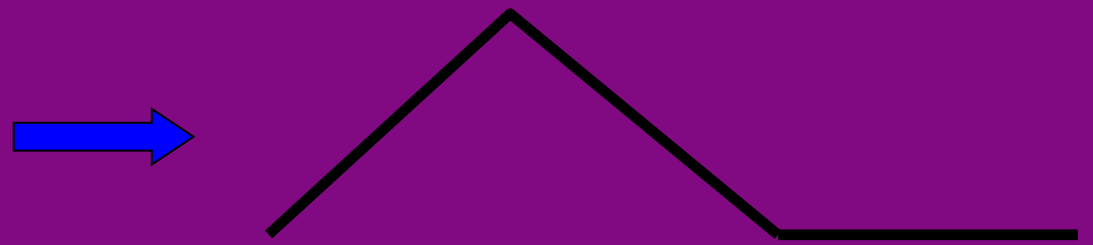
# HIPÓTESE DA JANELA ABERTA

## Janela Imunológica

Exercício Moderado



Exercício Intenso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Pedersen & Ullum, 1994

# MÉDIA DE INFECÇÕES DO TRATO AÉREO RESPIRATÓRIO SUPERIOR

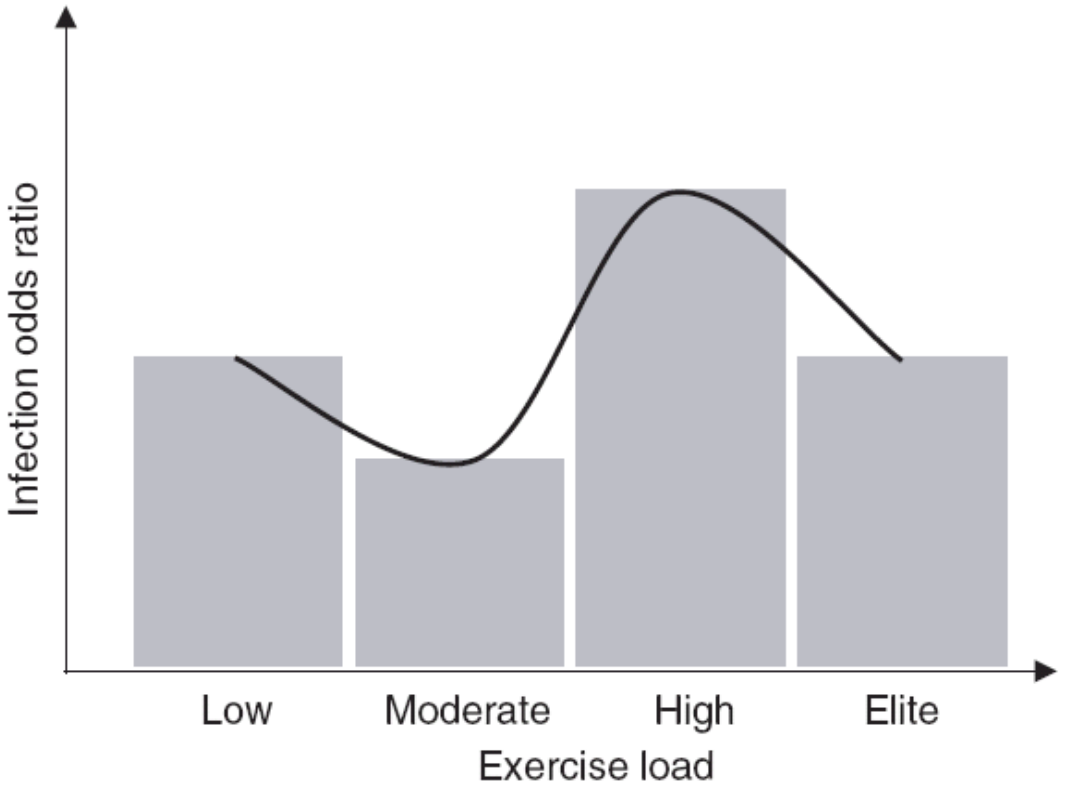


*Fig. 3.* Proposed S-shaped relationship between training load and infection rate.

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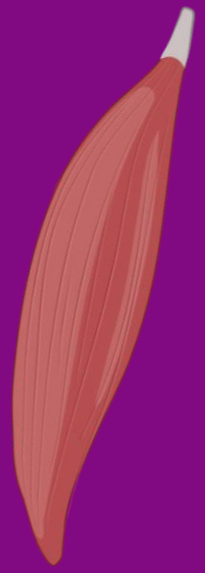
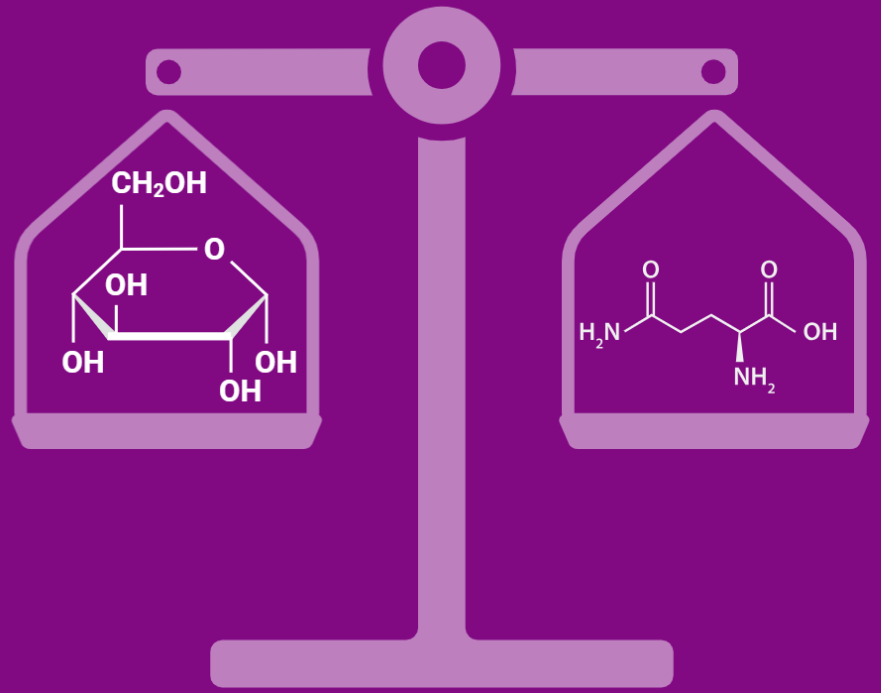
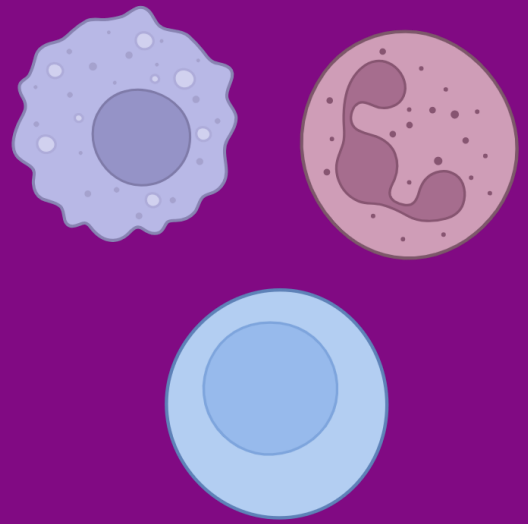
Malm, 2006

# QUAL A RELAÇÃO ENTRE NUTRIENTES, EXERCÍCIO FÍSICO E SISTEMA IMUNE?





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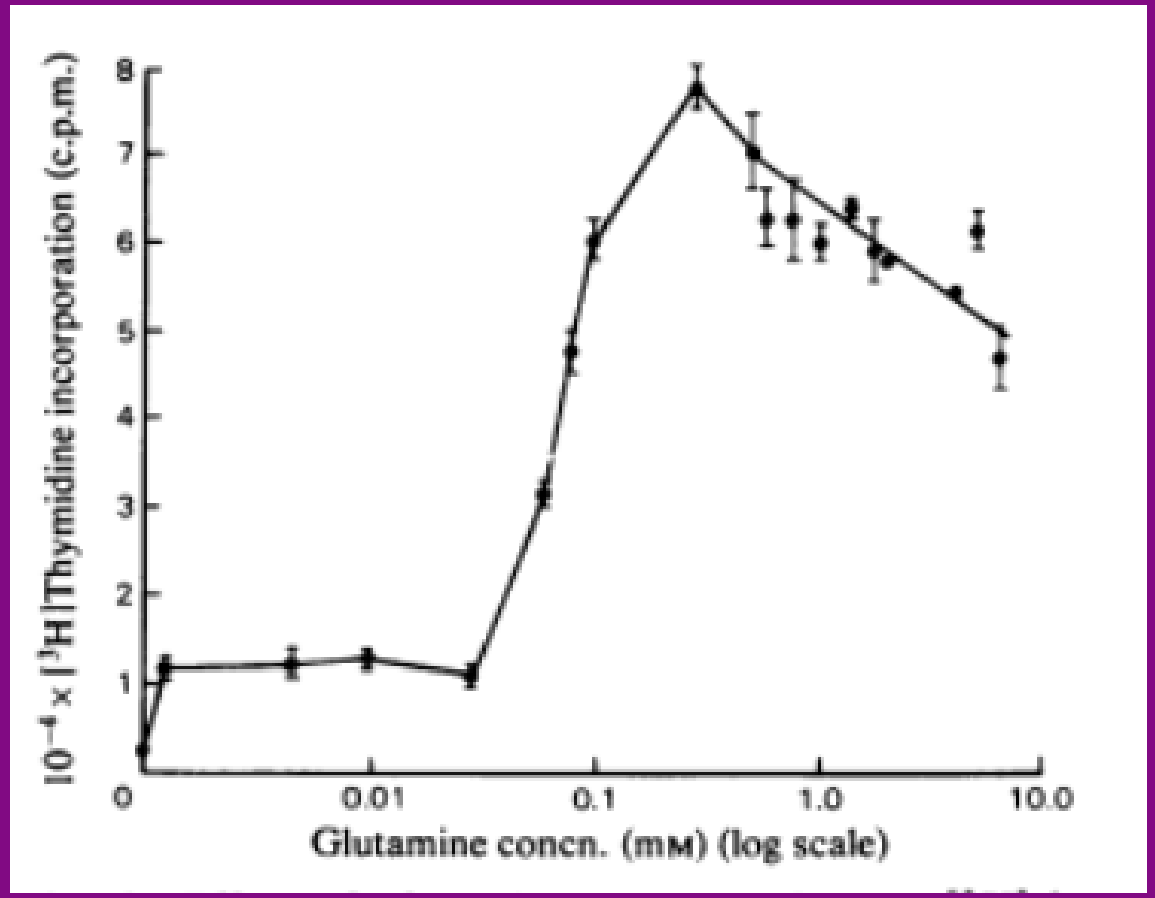
# GLUTAMINA E GLICOSE




Glutamina (80`s)

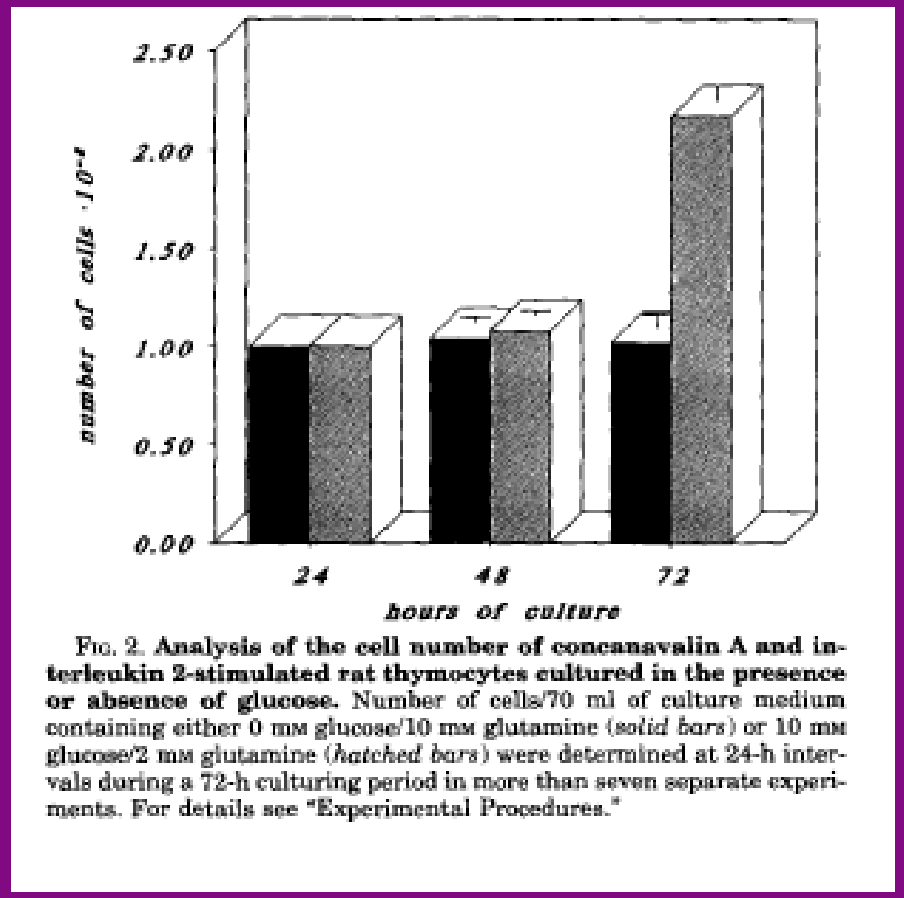



FIG. 2. **Analysis of the cell number of concanavalin A and interleukin 2-stimulated rat thymocytes cultured in the presence or absence of glucose.** Number of cells/70 ml of culture medium containing either 0 mM glucose/10 mM glutamine (*solid bars*) or 10 mM glucose/2 mM glutamine (*hatched bars*) were determined at 24-h intervals during a 72-h culturing period in more than seven separate experiments. For details see "Experimental Procedures."

Glicose (90`s)

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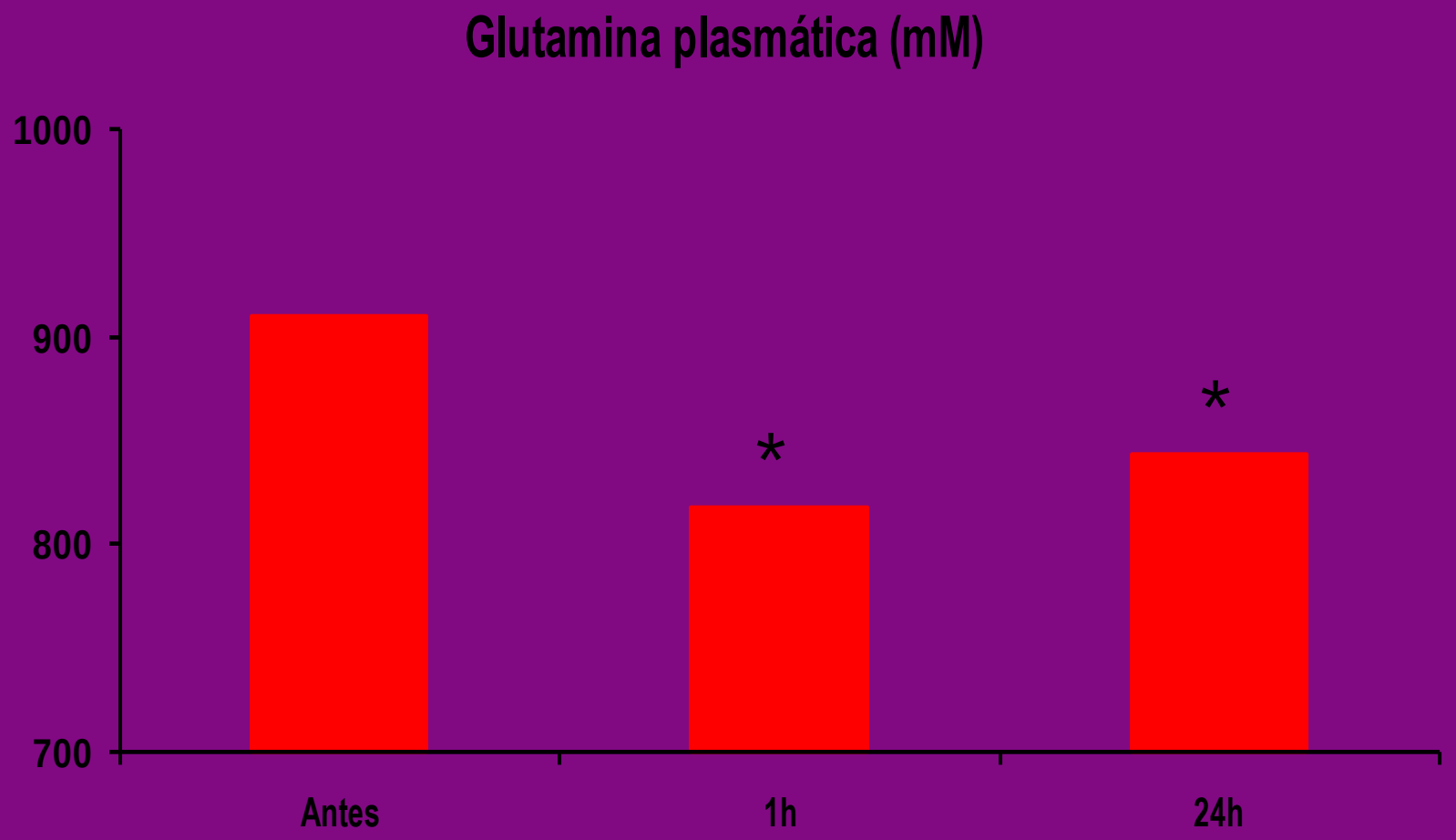
# GLUTAMINEMIA APÓS O EXERCÍCIO DE LONGA DURAÇÃO

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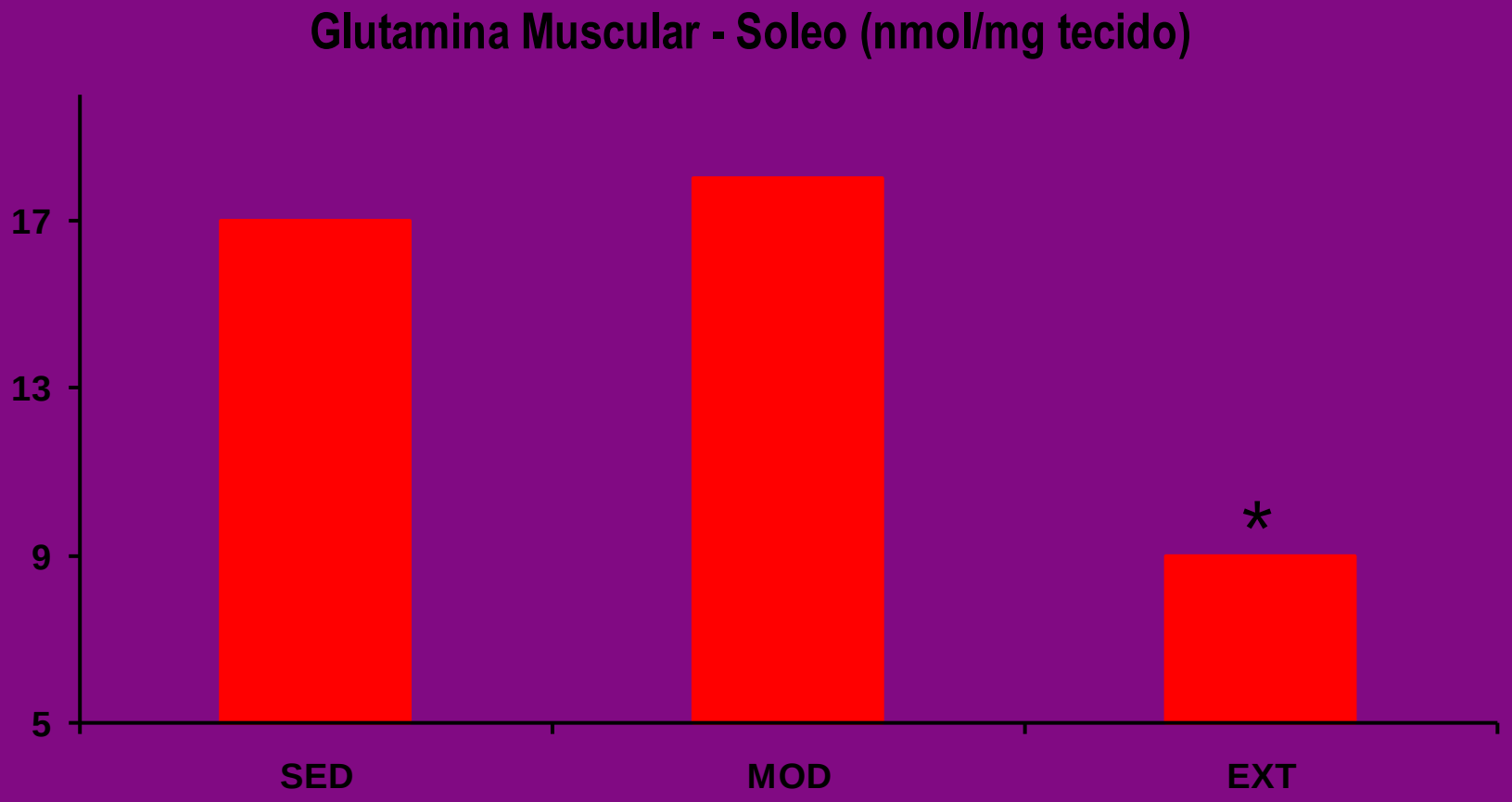
Castell e Newsholme, 1997

# MÚSCULO E PRODUÇÃO DE GLUTAMINA





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Santos et al., 2006

# SUPLEMENTAÇÃO DE GLUTAMINA?

Clinical Trial > Eur J Appl Physiol Occup Physiol. 1997;75(1):47-53. doi: 10.1007/s004210050125.

## Some aspects of the acute phase response after a marathon race, and the effects of glutamine supplementation

L M Castell [1], J R Poortmans, R Lecl

Affiliations + expand

PMID: 9007457 DOI: 10.1007/s004

> Med Sci Sports Exerc. 1997 Apr;29(4):474-81. doi: 10.1097/00005768-199704000-00008.

## Dietary L-glutamine does not improve lymphocyte metabolism or function in exercise-trained rats

L D Shewchuk [1], V E Baracos, C J F

Affiliations + expand

PMID: 9107629 DOI: 10.1097/000

Meta-Analysis > Clin Nutr. 2019 Jun;38(3):1076-1091. doi: 10.1016/j.clnu.2018.05.001. Epub 2018 May 9.

## The effect of glutamine supplementation on athletic performance, body composition, and immune function: A systematic review and a meta-analysis of clinical trials

Amirhossein Ramezani Ahmadi [1], Elham Rayyani [2], Mehdi Bahreini [3], Anahita Mansoori [4]

Affiliations + expand

PMID: 29784526 DOI: 10.1016/j.clnu.2018.05.001

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# SUPLEMENTAÇÃO DE GLUTAMINA?

**Conclusion:** According to this meta-analysis, generally, glutamine supplementation has no effect on athletics immune system, aerobic performance, and body composition. However, the current study showed that glutamine resulted in greater weight reduction. In addition, the present study suggests that the efficacy of glutamine supplementation on neutrophil numbers could be affected by supplement type and dose.

**Keywords:** Aerobic capacity; Body composition; Glutamine; Immune function; Performance; Strength.



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# Carbohydrate supplementation, glycogen depletion, and amino acid metabolism during exercise

A. J. Wagenmakers, E. J. Beckers, F. Brouns, H. Kuipers, P. B. Soeters, G. J. van der Vusse, and W. H. Saris

01 JUN 1991 // https://doi.org/10.1152/ajpendo.1991.260.6.E883

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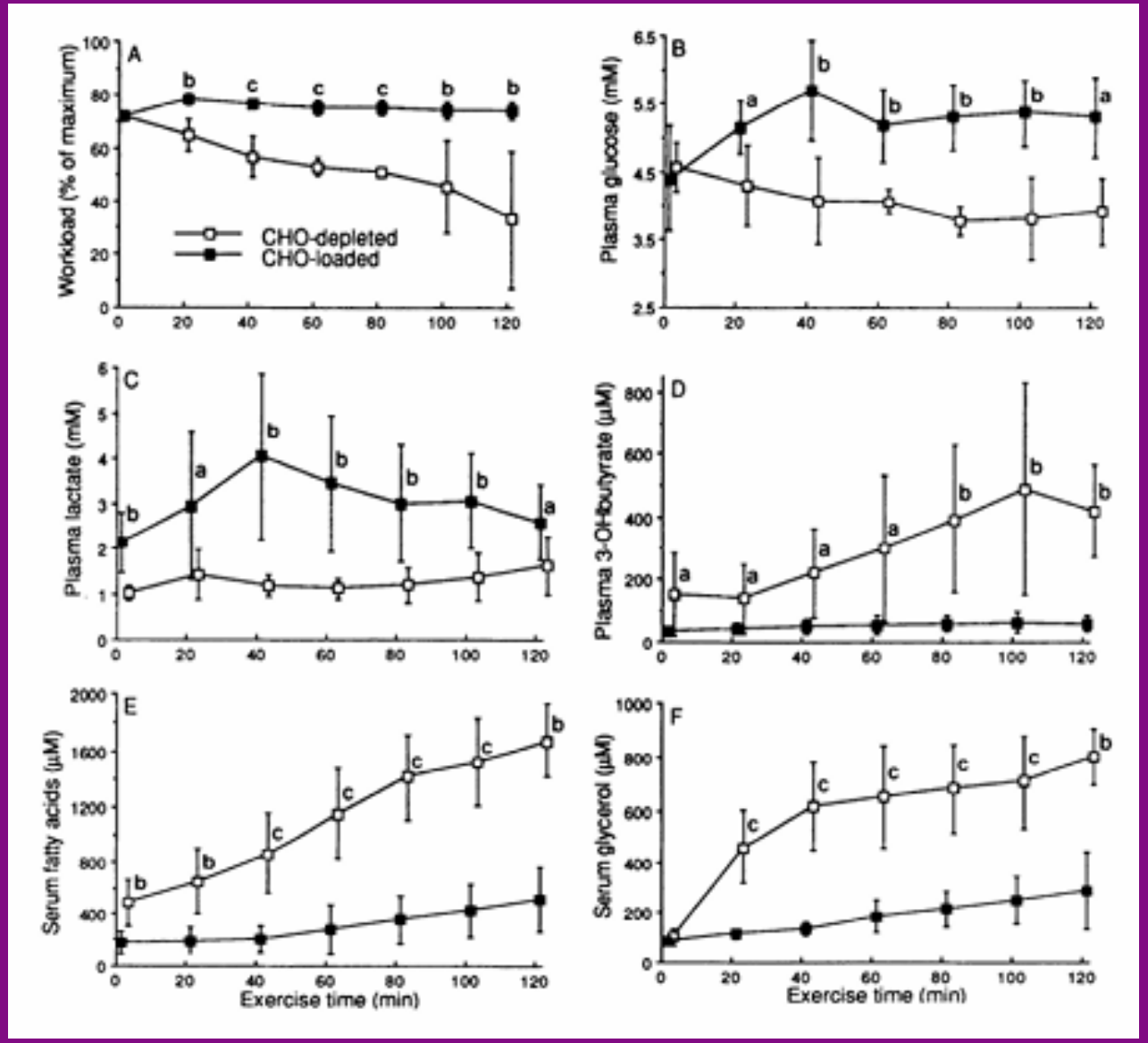


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# TREINO EM JEJUM?

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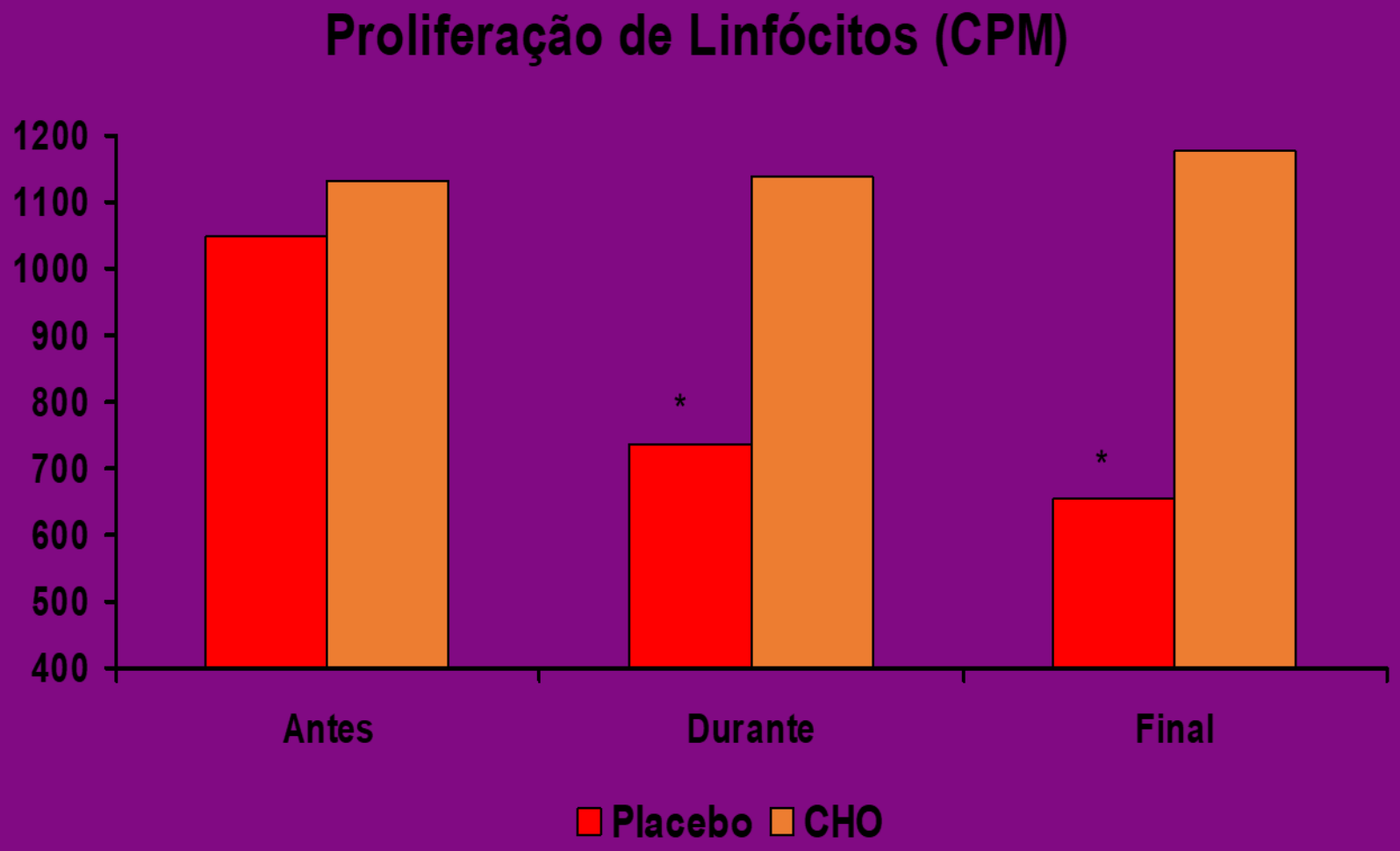
# SUPLEMENTAÇÃO DE CHO E SI

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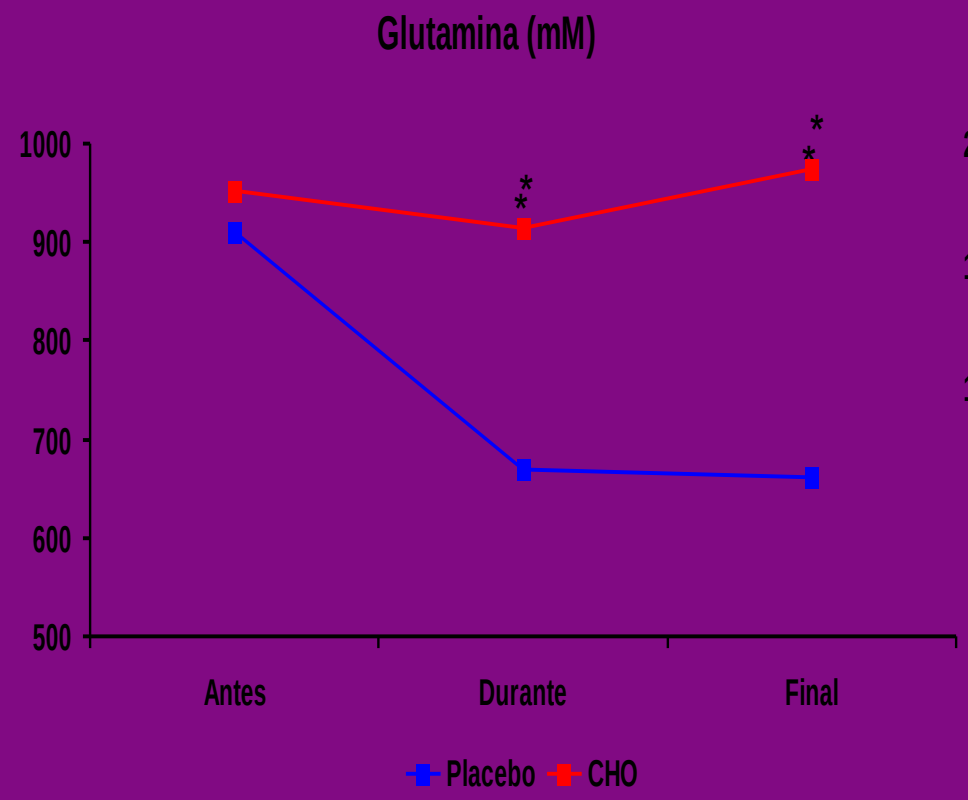
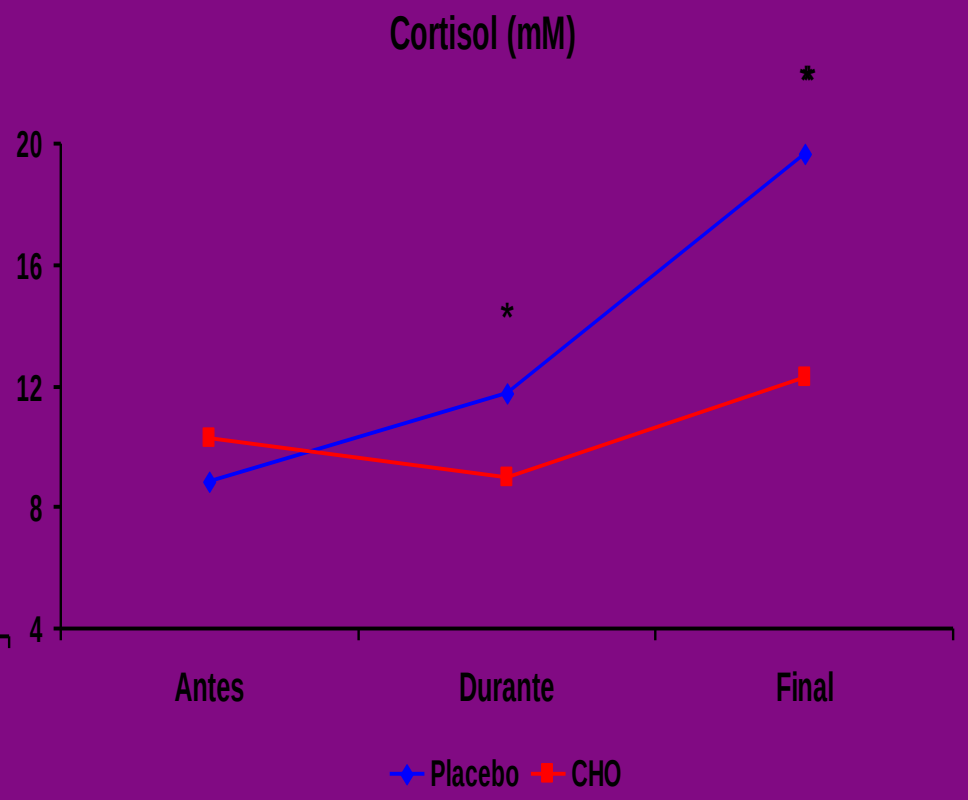
Bacurau et al.,2002

# RELAÇÃO GLUTAMINA E CORTISOL: PLACEBO X CHO

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# ESTOU GRIPADO, TREINAR OU NÃO?

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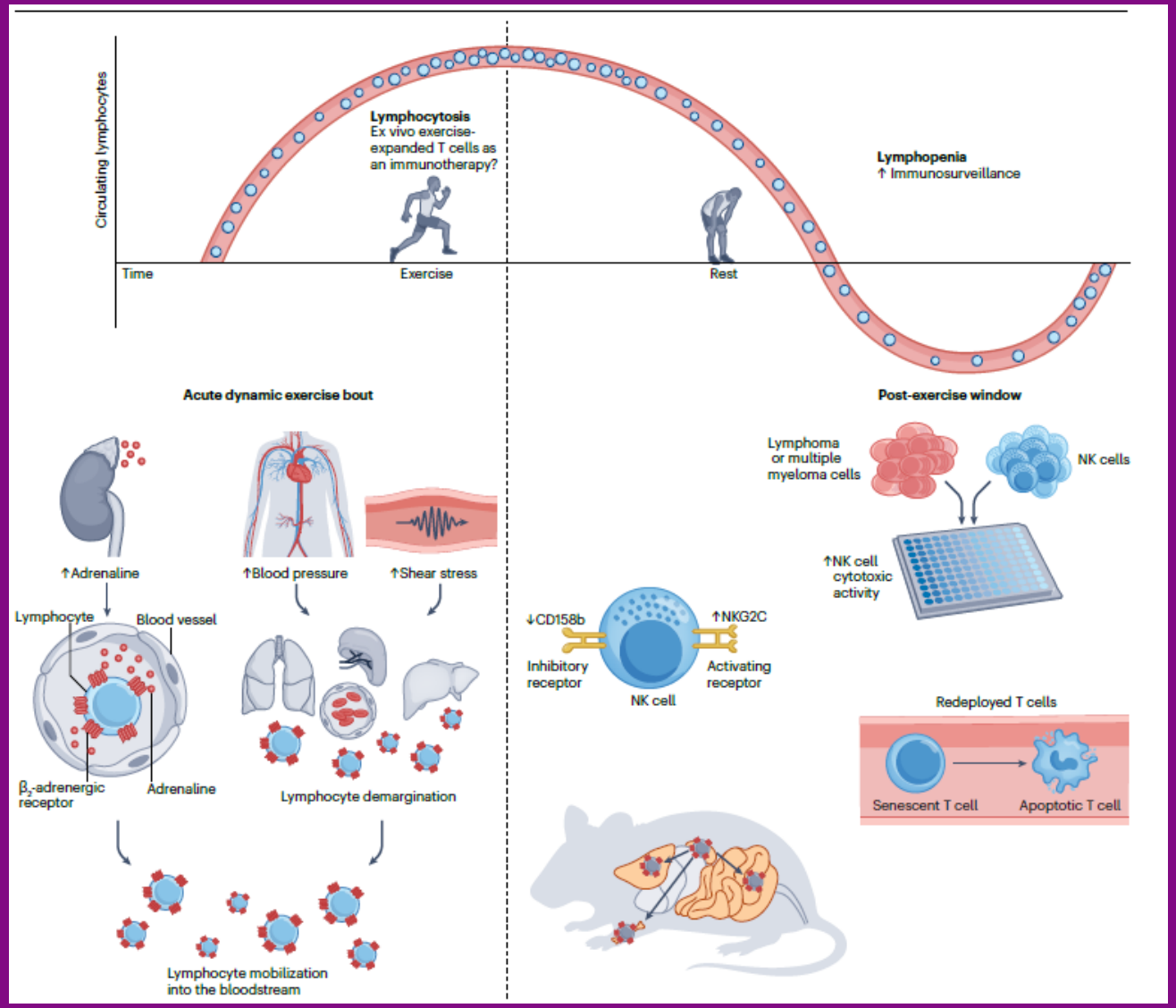
# EXERCÍCIO AGUDO COMO UM BOOSTER IMUNOLÓGICO.

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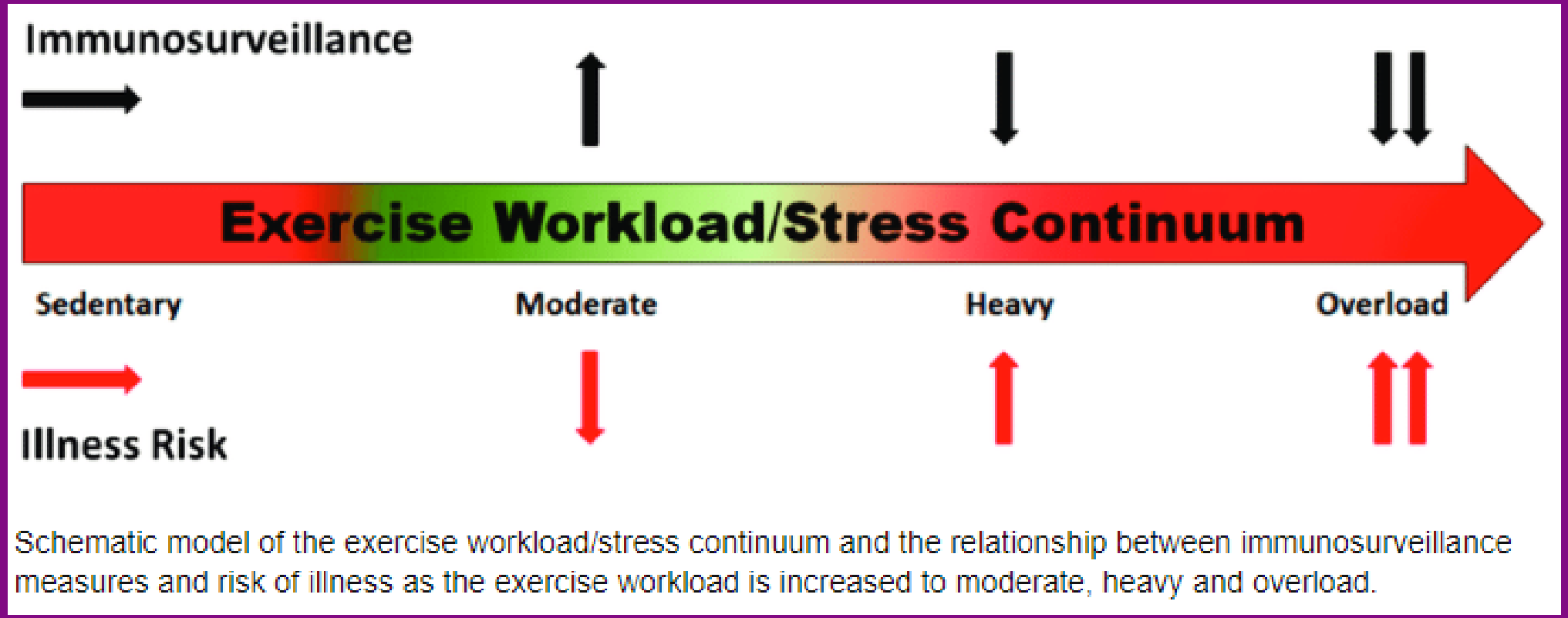
doi: 10.1038/s41577-023-00943-0. Fiuza-Luces et al. 2023.

# EXERCÍCIO E RISCO DE INFECÇÃO




Schematic model of the exercise workload/stress continuum and the relationship between immunosurveillance measures and risk of illness as the exercise workload is increased to moderate, heavy and overload.

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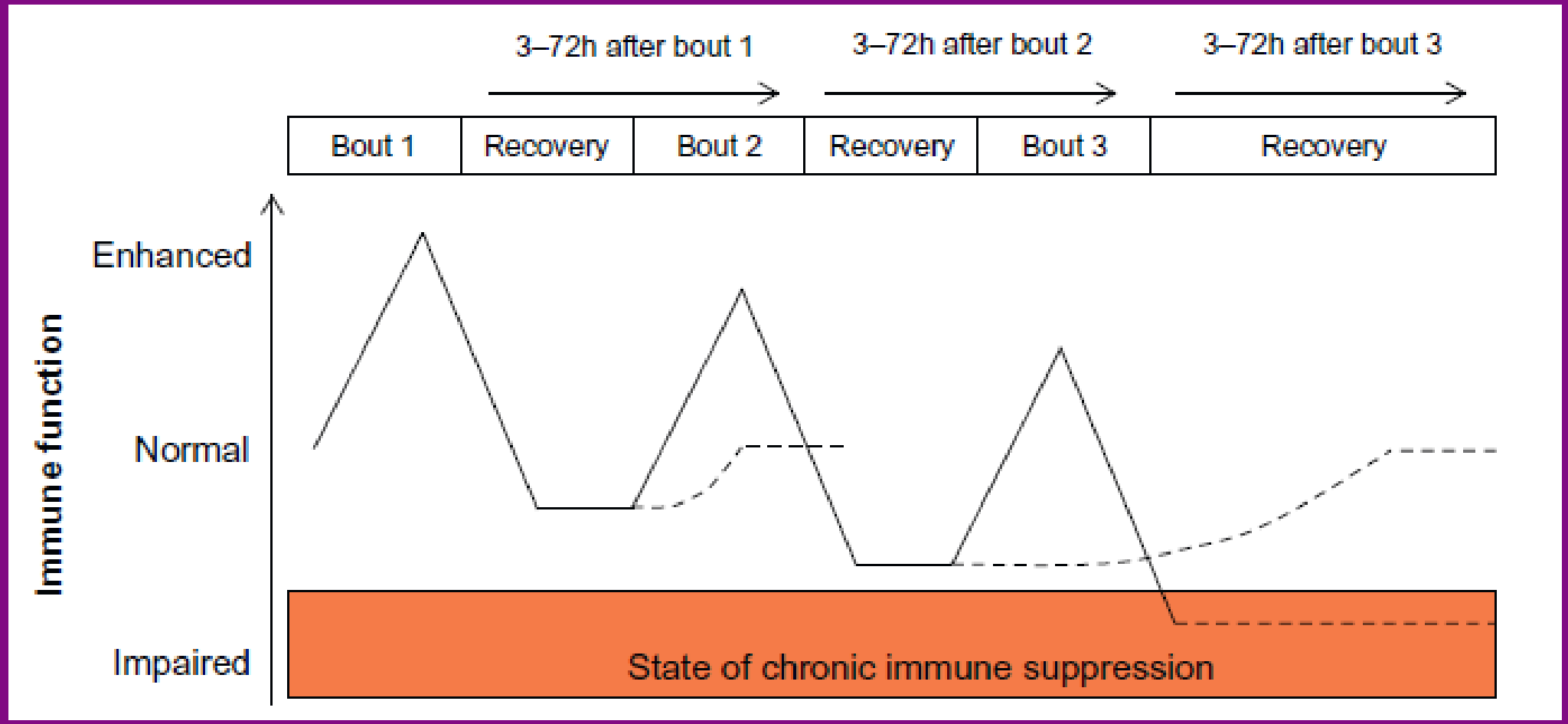
# OVERTRAINING E SI

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# RESUMINDO...

| Training Descriptor | Comment |
|---|---|
| Frequency | Increase the frequency of shorter training sessions rather than enduring fewer but longer sessions. |
| Volume | Reduce the overall weekly training volume and/or volume of individual training sessions. |
| Intensity | Avoid prolonged intensive training sessions or activities. Employ shorter sharper (spike) sessions mixed with lower-intensity work. |
| Load (volume x intensity) | Systematically manipulate the training volume and/or intensity to manage the degree of training load. |
| Load increments | Reduce the size of increments in frequency, volume, intensity and load of training e.g. increases of 5-10% per week rather than 15-30%. |
| Load sequencing – weekly microcycle | Undertake two or three easy-moderate training sessions after each high intensity session rather than the traditional pattern of simply alternating hard – easy sessions. |
| Load sequencing – multi-week macrocyle | Plan an easier recovery or adaptation week every 2nd or 3rd week rather than using longer 3 – 6 week cycles with increasing loads. |
| Recovery – session/week | Implement recovery activities immediately after the most intensive or exhaustive training sessions. |
| Recovery - season | Permit athletes at heightened risk of illness a longer period of passive and active recovery (several weeks) after completion of a season or major competition. |



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# SUPLEMENTAÇÃO E SISTEMA IMUNOLÓGICO

| Nutrient/Strategy | Rationale | Evidence | Likely Impact |
|---|---|---|---|
| Adequate nutrient availability (e.g., micronutrients, fluid) | Adequate nutrient availability maintains immunocompetence | ++++ | ++++ |
| High-CHO diet | Maintained blood glucose level → lower stress hormone levels → attenuated post-ex immune response | ++ | ++ |
| CHO ingestion during exercise | Maintained blood glucose level → lower stress hormone levels → attenuated post-ex immune response | +++ | +++ |
| CHO ingestion post-exercise | Attenuating effect on some immune variables (prevents lymphocytopenia, faster IL-6 return to pre-exercise level) during recovery | – | – |
| Dietary protein availability | Protein is needed for production of immune variables | ++ | ++ |
| Glutamine | Glutamine hypothesis; protein synthesis | – | + |
| BCAA | Precursors of glutamine | ++ | + |
| Creatine | Muscle trauma from heavy exercise → higher inflammatory markers (TNF-α, prostaglandin). Creatine prevents muscle trauma → attenuated inflammation markers | + | + |
| Cystine/theanine | Reinforced glutathione synthesis → reinforced anti-oxidative response & better immune function | + | + |
| Dietary fat intake | Low-fat: energy & micronutrient deficiency<br>High-fat: excessive intake at cost of protein/CHO | ++ | ++ |
| *n*-3 PUFA | Anti-inflammatory effects of *n*-3 PUFA | – | – |

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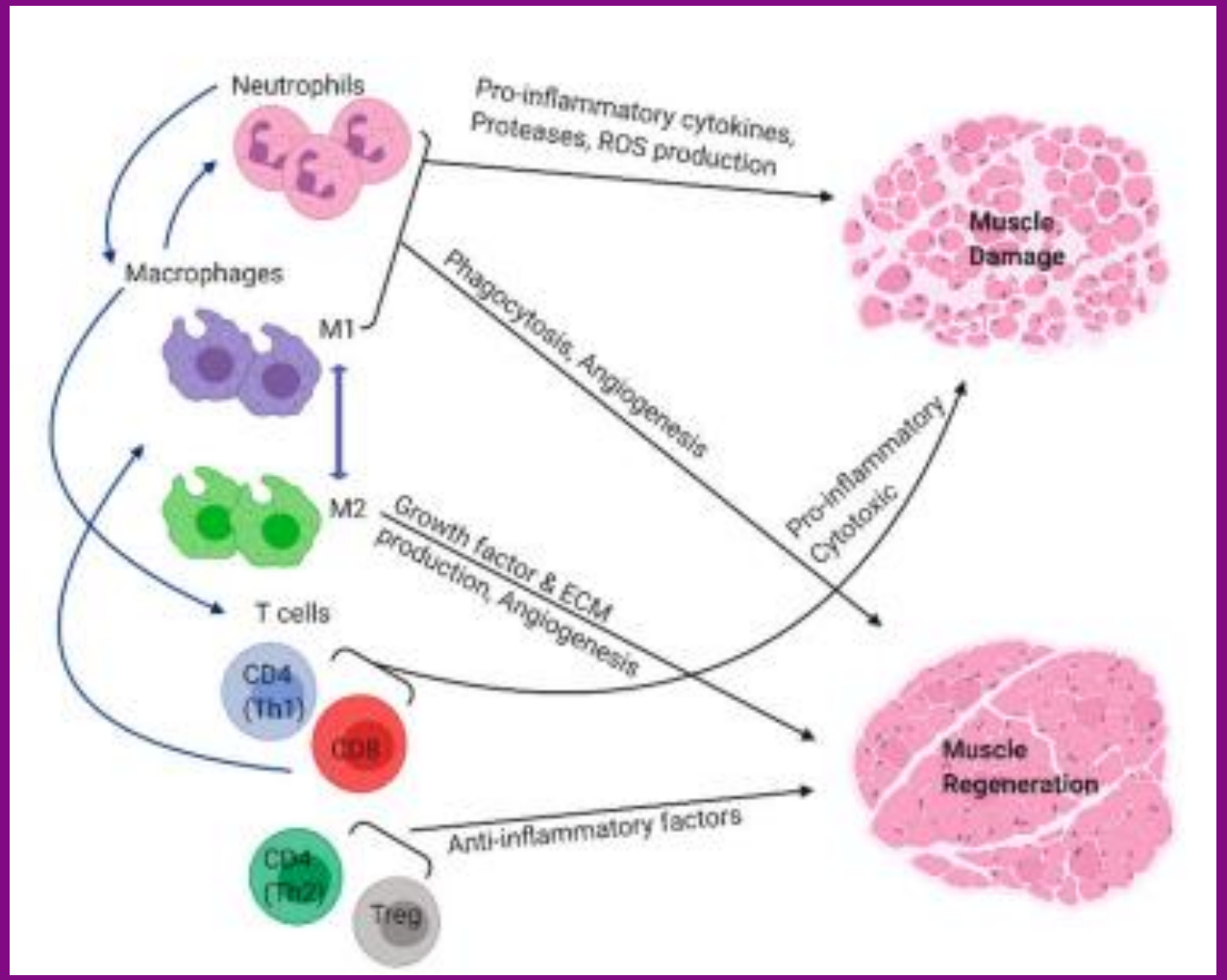
# TIPO DE EXERCÍCIO?

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# Informações seguras sobre a área

- The International Society of Exercise Immunology (ISEI)
- https://exerciseimmunology.com/

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@gersonleite.phd
@quatrodequinze
@cienciadoexercicio

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# Agradecimentos


Immunometabolism Research Group

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- Luana Biondo
- Julia Riccardi
- Kelly Isizuka
- Rafaella Oberhuber

Collaborators

- Prof. Dr. Fabio Lira.

https://sites.usp.br/immunometabolismlab/

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