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Effects of vegan versus meat-rich diet on markers of inflammation – a randomized, controlled trial

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Introduction: Vegan diet is known to show beneficial health effects and might be able to improve inflammatory activity. The underlying mechanisms remained widely unclear.

Methods: 53 healthy, normalweight subjects (ø 31 years old, ♀ 62%) were randomized to a controlled vegan (n = 26) or meat-rich diet (n = 27) for 4 weeks following a pre-treatment phase of a one week controlled mixed diet.

Results: In the vegan group, total leukocyte, neutrophil, monocyte and platelet counts decreased and after four weeks they were significantly lower compared to the meat-rich group (leukocytes p = 0.003, neutrophils p = 0.001, monocytes p = 0.032, platelets p = 0.004, Figure 1). Lymphocytes as well as basophilic and eosinophilic granulocytes remained similarly stable in both groups. Baseline values did not differ significantly. BMI remained stable.
Evaluation of correlations (Figure 2) speaks for an underlying molecular mechanism involving all three cell types. Analysis of serum amino acid levels revealed lower levels of branched-chain amino acids (BCAA) in vegan subjects (Table 1). Lower levels of BCAA are known to inhibit mTOR1, resulting in a downregulation of cell growth and differentiation[1,2]. Inhibition of mTOR1 leads to lower levels of GM-CSF[3,4], which was also significantly reduced in vegan subjects (p = 0.021, Table 2) confirming the hypothesis that vegan diet might be able to suppress mTOR1.

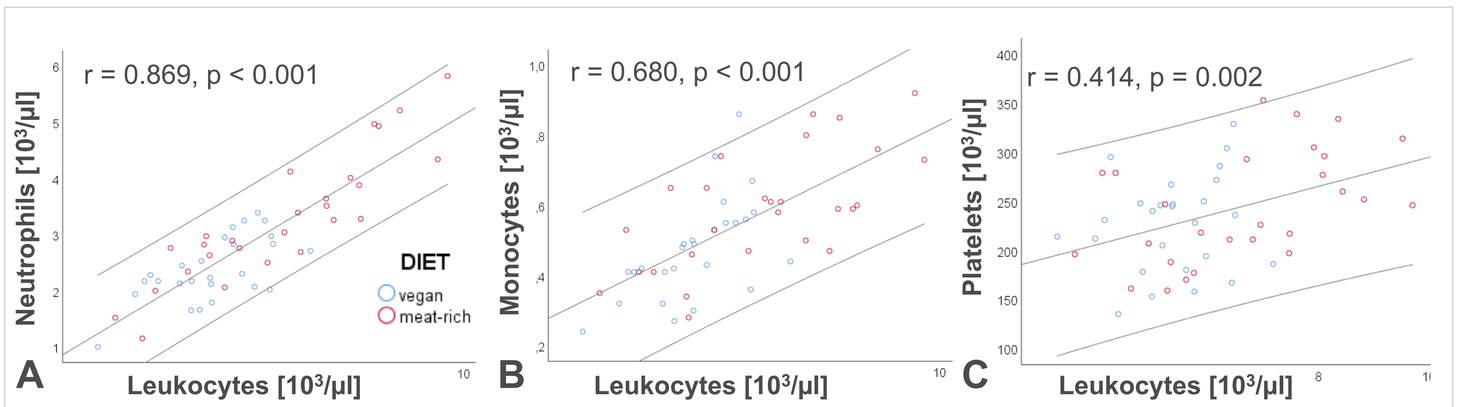

Figure 2: Correlation total cell count of (a) neutrophils, (b) monocytes, (c) platelets and leukocytes. Blue: vegan, Red: meat-rich group.

Table 1: End levels of BCAA

	Vegan (n = 26)	Meat-rich (n = 27)	p
Isoleucine [µmol/L]	70.7	80.4	**0.015**
Leucine[µmol/L]	141.4	159.9	**0.005**
Valine [µmol/L]	231.4	296.2	**<0.001**

Table 2: Changing of GM-CSF

GM-CSF [pg/mL]	Start	End	p
Vegan	174.9	131.7	**0.028**
Meat-rich	594.9	622.4	0.123

ANCOVA with consideration of baseline: p = 0.021

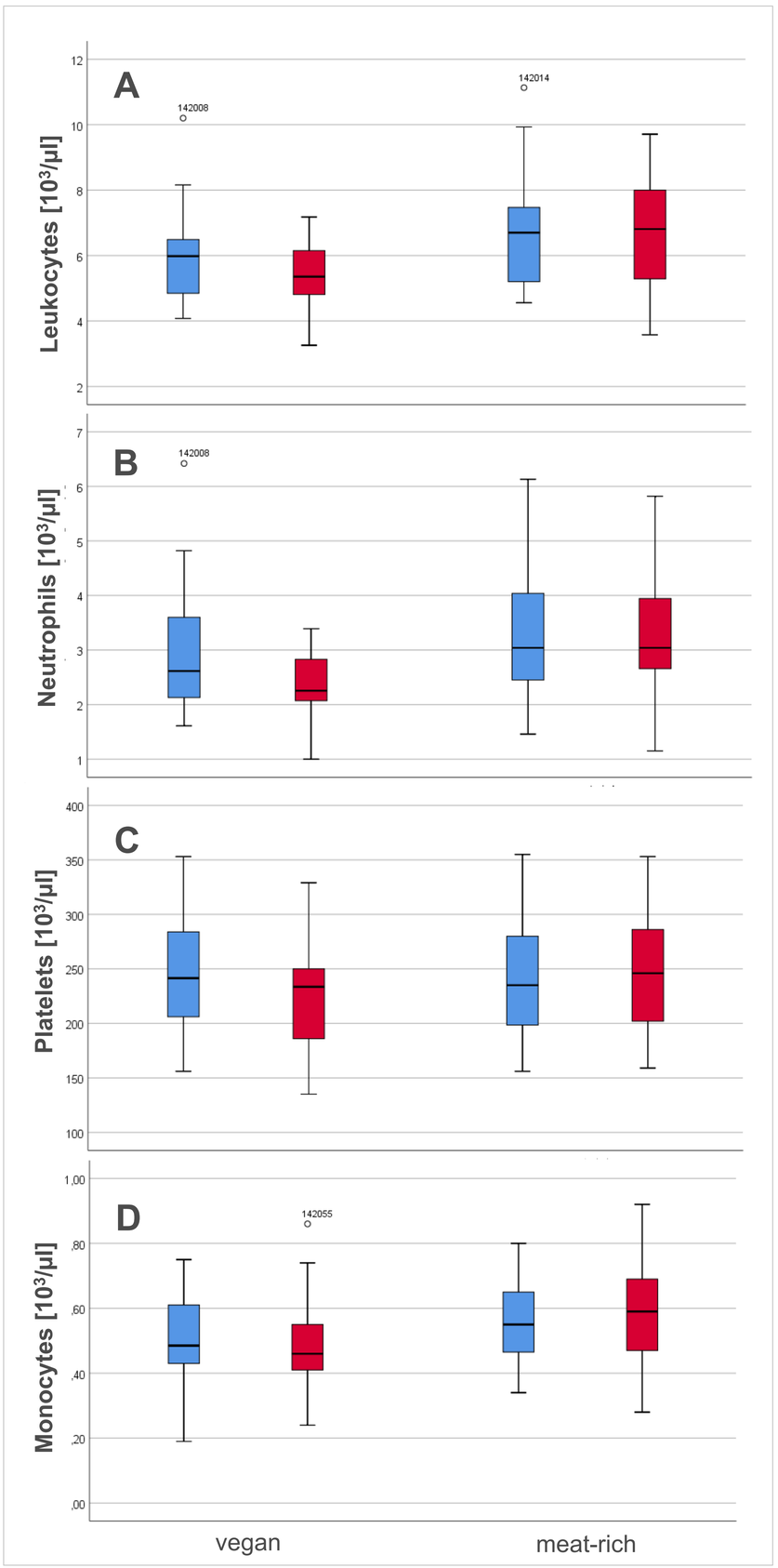

Figure 1: Total cell count of (A) leukocytes, (B) neutrophils, (C) platelets, (D) monocytes.
Left: vegan, Right: meat-rich group.
Blue: baseline, Red: end (after 4 weeks).

Conclusion

Four weeks of a controlled vegan diet affected the number of neutrophils, monocytes and platelets but not the number of lymphocytes. The relation with branched-chain amino acids and GM-CSF suggests a mode of action via the mTOR signaling pathway. This potential relationship needs to be verified by further research.

References: 1: Sengupta et al. Regulation of the mTOR Complex 1 Pathway by Nutrients, Growth Factors, and Stress. Mol Cell 2010, 2: Bonvini et al. Immunomodulatory role of branched-chain amino acids. Nutr Rev 2018, 3: Li et al. Identification of key regulatory pathways of myeloid differentiation using an mESC-based karyotypically normal cell model. Blood 2012, 4: Gomez-Cambronero J. Rapamycin inhibits GM-CSF-induced neutrophil migration. FEBS Lett 2003.