

Mucosal composition and glutamine metabolism during a 48-hour fast

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Glutamine (GLN) is believed to be an essential nutrient for the intestinal mucosa.(1) Interestingly both fasting and nutritional support when given as either enteral or parenteral feeding are associated with glutamine depletion and atrophy of the intestinal mucosa. While there has been intensive research on the intestinal effects of glutamine-supplemented nutritional support (2,3) the intestinal adaptation to fasting with respect to glutamine metabolism has been less studied. The aim of this experiment was to examine the effect of fasting on the activity of *glutaminase* and *glutamine synthetase* (the enzymes that regulate GLN metabolism).

Male Wistar rats (n = 6 per group) were randomly allocated to be either fed chow *ad libitum* (CHOW) or fasted (FAST) for 48 hours. At sacrifice, samples were taken to estimate total intestinal mass, mucosal mass, mucosal protein, and mucosal DNA content. Enzyme analyses were used to estimate the activity of *glutaminase* and *glutamine synthetase* per unit of mucosal protein. Data were described as mean \pm standard deviation and comparisons between the groups were performed using the non-parametric Mann-Whitney Test. The FAST group lost weight while rats in the CHOW group gained weight ($-28.5 \text{ g} \pm 7.1$ versus $+11.5 \pm 5.2 \text{ g}$, $P = 0.01$). The FAST group had a significantly lower intestinal weight (49.1 ± 10.3 versus $71.5 \pm 2.4 \text{ mg/cm}$ intestine, $P = 0.009$) and significantly decreased mucosal mass (17.28 ± 5.53 versus $28.10 \pm 4.23 \text{ mg/cm}$ intestine, $P = 0.02$). Fasting did not significantly alter mucosal composition as evidenced by mucosal DNA concentration (7.15 ± 2.38 versus $8.36 \pm 2.16 \text{ ug/mg}$ mucosa, $P = 0.35$) and mucosal protein concentration (0.076 ± 0.02 versus $0.118 \pm 0.01 \text{ mg/mg}$ mucosa, $P = 0.52$); nor did fasting significantly alter enzyme activities (*glutaminase*, 69.2 ± 8.1 versus $86.7 \pm 10.0 \text{ nmol/mg}$ protein/min, $P = 0.92$; *glutamine synthetase*, 11.3 ± 2.1 versus $13.1 \pm 3.8 \text{ nmol/mg}$ protein/min, $P = 0.81$).

In summary, a 48-hour fast significantly reduces total mucosal mass, but did not significantly alter the DNA and mucosal protein content of the mucosa. In addition, mucosal *glutaminase* and *glutamine synthetase* activities were not significantly altered. These results suggest that during a 48-hour fast intestinal atrophy proceeds despite no appreciable alteration in glutamine metabolism.

References

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