

## Effect of phosphorus supplementation on food intake and growth rate of rats maintained on gluten diet

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Wheat gluten is the major protein source in many developing countries. Gluten lacks some essential amino acids, primarily lysine, and, accordingly, can't foster optimal growth. For that reason, it should be complemented with a protein source containing the limiting amino acid to match human needs<sup>(1)</sup>. Further, wheat is known to contain limited amounts of available phosphorus<sup>(2)</sup>. We have recently found that the addition of phosphorus to a low protein diet (10 % egg white protein) in rats was able to attain a weight gain comparable to that of a normal protein diet (20 %)<sup>(3)</sup>. Therefore, a study was conducted to investigate whether phosphorus addition can affect growth of rats maintained on incomplete protein diet.

Forty male rats (~220 g) were randomly divided into four groups and maintained on diets containing 10 % protein in the form of wheat gluten (G) with added lysine (G + L) or phosphorus (G + P) or lysine plus phosphorus (G + L + P). The study was approved by the Institutional Animal Care and Use Committee (IACUC) at the American University of Beirut (AUB). Body weight and food intake were measured twice per week for 9 weeks. Average food intake, body weight and energy efficiency over the 9 weeks experimental period was calculated and data was analysed by a two way analysis of variance.

Table 1. Weight Gain (g/d), Food Intake (g/d) and Energy Efficiency (g/100Kcal)

	Weight gain (g/d)		Food intake (g/d)		Energy efficiency (g/100kcal)	
	Mean	SD	Mean	SD	Mean	SD
G	0.152	0.245	17.36	2.28	0.213	0.335
G + L	1.013	0.382	20.37	3.34	1.199	0.432
G + P	0.859	0.314	19.17	2.37	1.064	0.351
G + L + P	3.915	0.905	25.54	2.73	3.627	0.478
Two-way ANOVA P value	Lysine	<0.001	<0.001	<0.001	<0.001	<0.001
	Phosphorus	<0.001	<0.001	<0.001	<0.001	<0.001
	Interaction	<0.001	0.058	<0.001	<0.001	<0.001

Food intake was significantly different according to lysine and phosphorus, but not the interaction. Food intake of the lysine or phosphorus groups increased by about 15 %, while that of both (lysine plus phosphorus) increased by about 45 %. Weight gain and energy efficiency were significantly different according to lysine, phosphorus and interaction. Around 5 times improvement was seen following the addition of either lysine or phosphorus, and this was further exacerbated to 20 times with the combination.

In conclusion, enhanced growth following the addition of both lysine and phosphorus seems to be mainly related to efficient energy utilization rather than increased energy intake. Moreover, a combination of the missing amino acid plus phosphorus is required to improve the quality of a gluten based diet.

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