

Dietary carbohydrate solubility influences dam and litter liveweight changes over lactation in a highly fecund inbred strain of mice, the QSi5

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The solubility of carbohydrates or glycaemic index (GI) determines the kinetics of glucose processing and tissue accumulation and is important in maintaining euglycaemia. We are interested in factors defining lactational potential of a Quackenbush–Swiss mouse strain, inbred and selected for fecundity for 50 generations. Thus the impact of energy availability on changes in growth of suckling pups relative to dam liveweight fluctuations has been investigated.

Primiparous QSi5 females ($n = 17$) were mated and maintained on a high GI diet (Higgins, *et al.* 1996) in which the carbohydrate component consisted of glucose. At parturition litters were normalised to 12 pups (average litter size is 13.2 pups for this strain) and allocated to diets containing a high (H), medium (M) or low (L; $n = 5$ per group) GI carbohydrate component. In the LGI diet, high amylose starch was substituted for glucose, while 50% was substituted in the MGI diet. Pups and dams were weighed every 48 h and feed intake recorded over the 18 day lactation cycle.

Birth weights varied significantly; 1.45, 1.70 and 1.53 g (pooled SEM ± 0.19) for H, M and L GI groups respectively. Birth weight was correlated with pup growth rate ($r = 0.29$). Mean pup growth rates were 0.65, 0.61 and 0.58 g/day/pup (pooled SEM ± 0.05) for the H, M and L GI groups respectively: dietary effects were not significant but their interaction with time was ($P < 0.001$; repeated measures AOV). Peak pup daily growth rates were achieved on day 8 (H 0.84, M 0.86 and L 0.79 g/day) in each and declined thereafter to day 18. Mean pup weights at day 18, adjusted for birth weight, for the H, M and L GI groups respectively were 7.1, 7.3 and 5.9 g (pooled SEM ± 0.21) and were influenced significantly by diet and diet \times time

($P < 0.001$). Dam feed intake increased from 7.98, 7.05 and 5.45 g/day on day 1 to maximum values of 19.40, 25.13 and 25.54 g/day (pooled SEM ± 1.98) recorded on days 14, 15 and 18 for the H, M and L groups respectively. This was influenced significantly by diet ($P < 0.05$) and time of lactation ($P < 0.001$) between groups. When adjusted for dam body weight, feed intake reached peak values of 0.931 and 1.184 g/g body weight for the H and L groups respectively: the dietary effect was significant ($P < 0.027$) as was its interaction with time ($P < 0.001$). Litter growth (g) per unit of dam feed intake (g) in sequential 48 h periods were 0.21, 0.23 and 0.25 g/g feed (pooled SEM ± 0.03) from H, M and L GI diet groups respectively. These levels were maintained until day 8 and declined thereafter. There was no effect of diet, but the interaction between diet and time was significant ($P < 0.001$). Dam body weight was significantly influenced by diet ($P = 0.04$) but not time, with dam BW (adjusted for BW at pupping) being 41.8, 42.9 and 39.9 g in the H, M and L GI diet groups respectively averaged over the entire lactation.

The QSi5 mouse is capable of maintaining lactational performance by increasing feed intake and sustaining litter liveweight gain when dietary carbohydrate solubility is decreased. However, dramatic shifts result in a preference for the conservation of dam liveweight over maximal pup growth as dams are unable to ingest sufficient energy to maintain both.

Higgins, J.A., Brand Miller, J.C. and Denyer, G.S. (1996).

Development of insulin resistance in the rat is dependent on the rate of glucose absorption from the diet. *Journal of Nutrition* 126, 596–602.