Plenary 1: Nutrition and Cognition

Nutrition and cognition: how big a difference does it make?

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Objective – To consider the evidence that diet can have either long-term or short-term consequences for behaviour.
Long-term influences – There has been an emphasis on the importance of nutrition during the last third of pregnancy and the first two years of life when the brain develops rapidly, with various suggestions that inadequate nutrition at this stage can have long-term consequences. It is generally accepted that during brain development a shortage of iodine or iron can have long-term negative effects (Benton, 2008). More generally higher body weight at birth, thought to reflect the mother's nutrition, has been related to intelligence in later life (Richards et al., 2001). Some of the best data have been obtained from premature infants who randomly were allocated to a standard cows-milk based formula or one enriched with protein, vitamins and minerals. The enriched formula resulted in higher intelligence scores in boys (Lucas et al., 1998) who at fifteen years boys had a larger caudate nucleus, as measured using MRI (Isaacs et al., 2008). Such data strongly suggest that the nature of early nutrition can have long-term consequences. In this context we are only beginning to consider the optimal nature of diet, although recent epidemiological data have associated a higher consumption of fish during pregnancy by the mother, with higher intelligence in children at eight years (Hibbeln et al., 2007).
Food intolerance is another way in which behaviour can be adversely influenced over a long period. Benton (2007) used meta-analysis to review the use of an oligoantigenic diet (few foods) in children with a history of hyperactive symptoms. In five well controlled studies the standardized mean difference was 0.80 of a standard deviation (95% CI 0.41 to 1.19); there were significantly fewer symptoms of hyperactivity when the children consumed a placebo meal than when they ate what for them was a problem food. The responses were idiosyncratic with several dozen foods proving to be a problem. The findings should not be uncritically generalized to other groups as these were studies of children whose parents prior to the study suspected that food may be a problem.
Short-term influences – Nutrition can also potentially influence functioning from moment to moment. There is evidence that omitting breakfast interferes with cognition (Pollitt and Mathews, 1998). In nine years Benton and Jarvis (2007) reported that children who had eaten a small breakfast spent significantly less time attending to school work, an effect reversed by a mid-morning snack. Only recently has the composition of breakfast, rather than fasting, been considered. The idea that children benefit from the consumption of a breakfast with a low glycaemic load (GL) can account for much of the literature. In young adults breakfasts were compared that contained a similar amount of carbohydrate that differed in the speed with which glucose was released (Benton et al., 2003). A lower GL meal was associated with better memory. Benton et al. (2007) studied the effect of iso-caloric meals designed to differ in GL. In children aged six to seven years a low GL breakfast was associated with better memory, attention and spending more time on task.
The influence of other aspects of the nature of the diet that has been recently consumed have attracted attention, in particular the intake of essential fatty acids. Eilander et al. (2007) reviewed the topic and with term infants and children over two years of age could find little evidence of an enhancement of cognitive functioning associated with fatty acid supplementation. There was suggestive evidence that the giving of omega-3 supplement to pregnant and or lactating women benefited mental development although the effects were small and inconsistent. In contrast Benton (2007) found in a meta-analysis of eight studies that supplementation with the omega-3 fatty acids decreased hostility in children and adults (-0.61, 95% CI -0.83 to -0.39). Similarly, although as yet no conclusion is justified there is a series of studies reporting that multi-vitamin/mineral supplement increase intelligence (Benton, 2001; Osendarp et al., 2007) and decrease violence (Benton 2007; Gesch et al., 2002). There is no suggestion that such effects occur in other than a poorly nourished sub-set of the population.
Conclusion – Although the data are limited, and hence the details uncertain, there is increasing evidence that diet can influence behaviour and cognitive development. It is, however, important that such data are kept in context. Behaviour is influenced by many factors. The effects of diet are sometimes subtle, although on occasions in particular individuals the influence can be dramatic.

References

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