Crime and Nourishment: Cause for a rethink?

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Are we missing something?

The classic criminal justice model assumes that behaviour is entirely a matter of free will. This assists the often difficult task of sentencing but what is less clear is how one can exercise that free will without involving the brain. And since the brain is a physical organ, how can the brain function properly without an adequate nutrient supply? Straightforwardly, it can’t. Crime may often be described as brainless but we should not take that literally.

The authors argue that we need to bring the brain into criminal justice thinking and in doing so address the paucity of evidence that underpins assumption about what ‘causes’ people to offend. A stratum of evidence about the causes of crime or antisocial behaviour needs to be in place before we can talk about ‘prevention’ or ‘risk factors’ in any meaningful sense. Also, we are not acting on findings from studies designed to examine possible causal factors in antisocial behaviour, which give good reasons to question assumptions about culpability. These studies highlight factors such as poor diet that affect behaviour seemingly without our knowledge2.

Brain and behaviour

If it is true that we are what we eat then what are we turning ourselves into? No one would argue that our diet is unconnected with the increase in obesity but what we eat can not only be deposited as body fat but also contributes to the composition of our brain3. Food supplies the energy for our brain to function⁴, the raw materials for the neurotransmitters⁵ that influence communications in the brain and largely determines the operating environment for the brain. It is only 2 per cent of body mass and consumes about 20 per cent of available energy⁶. And yet we seem to have made major changes to modern diets in a relatively short space of time with little or no systematic examination of potential impacts on brain function or behaviour⁷. What is not widely appreciated is that our standards of dietary adequacy were not developed with brain function or behavioural outcomes in mind⁸. Given this, we may have seriously underestimated the potency of these physiological influences, and we ignore them at our peril.

Rethinking ‘Cause’

Determining what causal factors lead to criminal or antisocial behaviour raises many complex issues: What is crime, theories to explain such behaviour, the causal pathways to crime, how much crime there is and finally how do we best respond to it? It also raises methodological issues because in science causation must be demonstrated through rigorous experimental designs. Such precise methodology is rarely seen in criminal justice. Thus, there is a need to start by questioning what is understood by ‘causes of crime’ and consider the possibility that a complete tier of research is missing to underpin our approaches to criminal justice. Rethinking crime and punishment may need to start at

1. The authors would like to thank Dr Kathleen Taylor, Dr Jonathan Tamam, Dr William Cook, Ms Fiona Gillam and Ms Katrina Hiller for their kind contributions to the text. We also would like to thank: The Wellcome Trust for funding the research. The Charitable Trusts that have supported Natural Justice over the years. And the staff of HMYOIs Hindley, Lancaster Farms and Polmont for their kind support of our research.
8. ibid.
a much more fundamental level to create the proposed basis for ‘evidence based policy-making.’

The Government’s strategy is to be ‘tough on crime, tough on the causes of crime.’ As a strategy it could only work if you were prepared to be tough on the causes but its weakness lies in the lack of evidence about what these ‘causes’ are. One has to ask when any of the factors commonly referred to as a cause of crime or antisocial behaviour have ever been demonstrated experimentally as science requires? Frequently the term ‘cause’ is used incorrectly because what is referred to is actually a correlation. A correlation simply means that A is related to B, it tells us nothing about the nature of that relationship. Such correlations are also frequently presented as ‘risk factors’ suggesting we can predict who will offend and thus involve them in preventative interventions. Yet what exactly can a correlation predict when it tells us nothing about the nature of a relationship between a given factor and offending? Thus, interventions based on such correlations can at best be described as amelioration and concerns that such ‘preventative’ interventions are labelling is fully justified. In a nutshell, how can we prevent offending if we do not understand what causes it? Yet such propositions are commonplace in criminal justice and underpin many forms of intervention.

Rethinking what works

This leads one to question how safe are the assumptions that underpin the efficacy of current practice in criminal justice. There is an urgent need for evidence based policy but that has to be based on something better than correlations. There are two additional proofs to establish a cause. Namely that A precedes B and that the relationship of A and B is not due to C. To achieve these two additional controls you need to use rigorous experimental designs. We may hope that an intervention has helped reduced offending, but without adequate controls to test the approach, that remains a hope. This is not just semantics. Information is after all only as good as the means used to obtain it.

‘The effectiveness of most crime prevention strategies will remain unknown until the nation invests more in evaluating them’\(^9\). The purpose of such comments is not to disparage existing approaches or question the sincerity of intensions but to highlight the need to raise the bar when it comes to research intended to inform criminal justice policy. For instance, the public costs of testing cognitive skills approaches in the prison system was reported in the London Times\(^10\) to cost £150M and this approach was found to be ineffective\(^11\). Faced with escalating costs, the US Department for Justice commissioned a report by the Collation for Evidence-Based Policy\(^12\) which argued that ‘Progress is often thwarted by Government programmes and strategies that are not based on rigorous evidence.’ They recommended that in future, interventions should be evaluated by randomized designs. It is noteworthy that a report\(^13\), commissioned by the Home Office to review and update knowledge of ‘what works,’ acknowledged that ‘weak research design has contributed to lack of knowledge of what works.’ However, the programmes discussed in this report ‘rarely achieve’ a standard that meets the ‘randomized’ standard recommended by Baron et al as the sole basis for strong evidence of efficacy with which to underpin criminal justice policy. This has clear implications for the methodology used in ‘accrediting offender programmes.’

Diet and antisocial behaviour

Certain dietary choices, including fish consumption, balanced intake of micronutrients, and a good nutritional status overall also have been associated with reduced rates of violent behaviour’.\(^14\)


\(^10\) 18 November 2003.


The suggestion that diet may affect behaviour is not new. During the early nineteenth century the prevailing thinking was that criminal justice served deterrence with the gallows or imprisonment that comprised hard labour, seclusion and a minimal diet. The reformers’ movement in the UK, most notably Howard, Bentham and the Quakers such as Elizabeth Fry, rejected the violence of the gallows. The Quakers in particular advocated a need to restore the criminal by rebuilding of the man, spiritually, morally and physically. In 1818 they established the Society for the Improvement of Prison Discipline. Within 20 years this was the most influential group within UK prison reform. In 1821 they advocated the importance of cleanliness, religious instruction, adequate nutrition and classification. They faced criticisms of mollycoddling prisoners and subsequently emphasised the need for discipline and constructive labour. It sounds all too familiar, except that nowadays the press has been particularly positive about work of our charity Natural Justice!

The link with diet has been revisited regularly with increasing sophistication. For example in 1983, a time series study of 3000 imprisoned juveniles over 24 months was conducted in California with a more limited dietary change where refined and sugary foods, snack foods and drinks available to the inmates were replaced with unsweetened fruit juices and popcorn. Here it was reported that there were 21 per cent (P< .05) fewer serious antisocial acts over a 12 month period, 25 per cent reduction in assaults, 75 per cent reduction in use of restraints and 100 per cent reduction in suicides. Such dietary studies have been criticised for not being able to demonstrate a causal relationship and for lacking placebo controls. We note that such criticism was not applied to the social approaches to offending despite it being equally applicable. Despite the methodological limitations, the effect sizes were sufficiently impressive to make the case for follow-up studies.

The charity Natural Justice obtained the cooperation of the Home Office to conduct an empirical study to test if poor nutrition is a cause of antisocial behaviour. This required a rigorous experimental design and was undertaken in HMYOI Aylesbury. We found that the prisoners made poor food choices which resulted in many of them consuming diets that fell below government standards. We wanted to find out what happened to their behaviour when these nutrients were reinstated. We used food supplements as an analogue of a better diet because it provided the possibility of a placebo control. On a random basis, where neither the volunteers, prison staff nor researchers in the prison knew who was getting which type, 231 volunteers were given either placebo or real capsules containing broadly the daily requirements of vitamins, minerals and essential fatty acids. The number of proven offences committed by each participant was monitored before and while taking supplements. The result was that those who received the extra nutrients committed an average of 26.3 per cent fewer offences compared to placebos, which was statistically significant. Those consuming real supplements for at least two weeks committed 37 per cent fewer (highly statistically significant) of the most serious offences committed.

### Table 1

<table>
<thead>
<tr>
<th>Ratio of Rate of Disciplinary Incidents</th>
<th>Active</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>During Supplementation</td>
<td>0.737</td>
<td>0.993</td>
</tr>
<tr>
<td>Before Supplementation</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>


serious offences, such as violence, whereas those taking placebos remained within standard error and hence showed no real evidence of change in their propensity to offend. The statistical power for the study was 92 per cent which indicated that the size of the study was sufficient to address the hypothesis tested.

Such prisoners would not be expected to change their behaviour readily\(^\text{17}\). Here was evidence of change that could not be explained by ethnic or social factors, or variations in the administration of Governor reports etc, as they were controlled for by the randomised design. Because no one in the prison knew who was getting real or placebo capsules, it had to be the nutrients in the capsules that caused the change in behaviour. The importance of establishing efficacy with rigour becomes clear, because the institution had a high staffing level and the latest ‘incentives’ strategy. Nevertheless the placebo group did not alter their propensity to offend over time. Yet at our first attempt, improving the prisoners’ nutrition — something not even addressed in criminal justice — yielded a significant effect.

A report of the Aylesbury findings was agreed with the Home Office in December 1998. To date the Dutch have been the only Government to take up the approach but others are now showing interest. The Dutch government press released provisional findings of their own study that appears to replicate our findings: the difference in rates of offending between 221 prisoners taking active or placebo capsules is reported as 47 per cent. This larger effect is in part because unlike our findings, the rate of offending increased in the Dutch placebo group over time. When the drug-related offenders were removed from the analysis the difference between the active groups was 61 per cent. This 61 per cent figure matches a dose-ranging Californian 402 subject double blind randomised controlled trial\(^\text{18}\) where a similar formulation based on 100 per cent of the US recommended daily allowance of vitamins and minerals. The basis of the analysis in this study differs from our UK and Dutch studies, but we find the conclusions are consistent.

We are currently working on a much larger study of 1000 prisoners, which will be conducted at HMYOIs Hindley, Lancaster Farms and Polmont in Scotland. We are indebted to the Wellcome Trust for their vision in funding this research and to the positive support of the Institutions’ staff.

**Rethinking Culpability**

Central to any form of criminal justice is the notion that culpability can be attributed. Culpability is distinct from simply establishing guilt as the degree of individual liability is judged in relation to an action. The classical form of justice assumes that man is an agent of free will who can choose to commit an offence; hence culpability can be attributed. But what happens if there are factors that affect our behaviour without even the offender’s knowledge?

Evidence from the Aylesbury study above showed exactly that, since the participants did not guess accurately what sort of capsules they had been given. Here we have a potent effect on behaviour that (unlike alcohol) appears to act without our knowledge. Therefore, if an individual is unwittingly undermined by poor nutrition, those around them are unlikely to know about it either and would tend to attribute any inappropriate behaviour to deficits in the person’s personality etc. It is apparent that on a societal scale, these problems are liable to be greatly amplified as greater numbers of social interactions are subject to these hitherto unnoticed influences on our behaviour. This could even shift socially acceptable norms of behaviour without our knowledge\(^{19}\).

Such claims may sound farfetched but few would have predicted the potency of the effects shown in these empirical double blind prison studies. And more evidence is emerging. Nutrition will also interact with important social factors such as poverty, stress, the fragmentation of family but unless we know better we will interpret these events entirely in terms of what we can see. Yet physiological factors may be important in understanding tragic and irrational acts which defy a rational explanation. Nutrition is not the only

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exploration of antisocial behaviour, but it might form a significant part.

Awareness offers hope because if this scenario is correct, this process can be reversed if we choose to nourish our children rather than sentencing them for influences on their behaviour that we have not taken into account. This lays the foundation for a real rethink about the nature of volition and culpability. One has to ask what would the future have held for the prisoners we studied if they had grown up with better nourishment? Sadly, we don’t know but it bears thinking about. Indeed, evidence from a Mauritian longitudinal study of eighty-three children given an enriched nutritional and social environment at age 3 to 5 years showed that they were significantly less likely to be involved in antisocial behaviour at age 17 years or criminal behaviour at age 23 years compared with 355 matched controls20. The beneficial effects of the intervention were greatest for children who showed signs of malnutrition at age 3 years.

Our new study will investigate how diet affects cognitive processes that are associated with offending, such as risk taking and impulsivity. The design will allow us to relate changes in these cognitive process to those taking active or placebo capsules. This should provide important evidence of how any changes in behaviour are mediated.

**Rethinking crime in the community**

These findings have obvious relevance to crime in the community, because certain nutrients are essential irrespective of where you live. It is not where you eat that is important but what you eat. We have already conducted a pilot study that used a nutrition-based approach as an alternative to custody21 and have assisted the World Health Organisation with preliminary estimates of the influence of diet on global violence22. Subject to funding we hope to repeat these double blind studies in the community to test the relationship between nutrition and crime directly.

**Rethinking prison food**

In this context, the statement that ‘all we need is a well balanced diet’ is not very helpful because little is known about the optimal nutritional status for behaviour. The best diet currently known for the brain seems to be the traditional Japanese diet, which is very different to that offered in UK prisons. Indeed, one of the aims of our new study is to explore this area by relating changes in nutritional status to changes in behaviour under double blind conditions. One of the most scientifically intriguing aspects of our research is that the prisoners received three meals a day and despite making poor food choices, their diets were possibly better than those consumed by many young men of the same age in the community. Yet the improvement in behaviour from boosting prisoners’ diets was remarkable.

The focus of current prison diet seems to be based around providing a range of choices at a minimal price point. We found previously that the diet provided by the kitchen was commendably close to government guidelines given the budgets, and our pilot work in the current study suggests that is still the case. However, we found that the prisoner’s poor food choices undermined the nutritional value of what was actually consumed. Again, preliminary work for the new study suggests that remains the case. Some of the participants had not heard of vitamins, let alone knew which foods contained them. They were not equipped to make healthy food choices. This raises the need for the dietary education for prisoners which would empower them to take a more informed interest in what they eat.

Offering dietary choice is clearly important but if we can accept that the brain has a role in behaviour, as the evidence underlines, then the physiological consequences of the poor food choice on the brain will also affect the prisoner’s ability to choose without the prisoner even being aware. This is not crude determinism, but a feedback cycle where choice will inform what we put into our mouths, while the nutrients in the food will support the operation of the

### Average food composition from the canteen list

<table>
<thead>
<tr>
<th>Description</th>
<th>No items</th>
<th>Average size (g)</th>
<th>Energy content (kcal)</th>
<th>Contribution to Energy (per cent)</th>
<th>per cent RNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate</td>
<td>14</td>
<td>67</td>
<td>334</td>
<td>49</td>
<td>41</td>
</tr>
<tr>
<td>Snacks</td>
<td>15</td>
<td>165</td>
<td>847</td>
<td>56</td>
<td>6</td>
</tr>
<tr>
<td>Sweets</td>
<td>15</td>
<td>186</td>
<td>682</td>
<td>91</td>
<td>0</td>
</tr>
<tr>
<td>Drinks *</td>
<td>15</td>
<td>264</td>
<td>127</td>
<td>14</td>
<td>73</td>
</tr>
<tr>
<td>Fruit and</td>
<td>12</td>
<td>136</td>
<td>77</td>
<td>3</td>
<td>38</td>
</tr>
<tr>
<td>Veg</td>
<td>12</td>
<td>229</td>
<td>1056</td>
<td>40</td>
<td>27</td>
</tr>
<tr>
<td>Biscuits</td>
<td>14</td>
<td>766</td>
<td>30</td>
<td>25</td>
<td>37</td>
</tr>
<tr>
<td>Baked goods</td>
<td>12</td>
<td>299</td>
<td>15</td>
<td>23</td>
<td>52</td>
</tr>
<tr>
<td>Rice</td>
<td>3</td>
<td>758</td>
<td>15</td>
<td>15</td>
<td>46</td>
</tr>
<tr>
<td>Noodles</td>
<td>3</td>
<td>758</td>
<td>15</td>
<td>15</td>
<td>46</td>
</tr>
<tr>
<td>All groups</td>
<td>121</td>
<td>14983</td>
<td>32</td>
<td>32</td>
<td>28</td>
</tr>
</tbody>
</table>

*Includes low fat diet *sn*ot including milks *unrefined sugars*
senses that inform our choices. No one would suggest it was a matter of choice if a lack of iodine resulted in developmental brain damage to a child’s brain.

How we interact with food is likely to be a complex function of choice, family, peer-group, physical activity, economics, food distribution, and physiology. With the availability of such a variety of healthy foods to choose from today it is intriguing to consider why we do not manage to make better food choices. It has been proposed that energy density influences energy intake due to weak satiety signals that fail to compensate for very energy-dense foods23. Another possibility is that high fat and sugar diets influence the same neural circuits in the brain as drugs of abuse24. And when this is withdrawn they exhibit signs of withdrawal25, again, much like drugs of abuse. Increasingly these observations are being replicated in studies with drug users26,27. Hence there needs to be some caution using focus groups to determine what the prisoners want to eat since there appears to be emerging evidence of addictive components in modern diets. It is noteworthy that the national consumption of sugar has reportedly increased seven fold in just 200 years28. With this in mind we analysed the sugar and fat composition of the current canteen list.

We suggested in 2000 that the canteen should have a traffic light system to highlight to prisoners which foods are healthier options, and that there should be more fresh produce available. This seems to have been largely ignored. Foods from the canteen are still high in fat, salt and sugar as we found previously, are likely to undermine the nutritional value of the diets consumed by prisoners, and increase disciplinary problems29. It is worth pondering why such foods are so freely available.

Rethinking the management of prisoners

Without precise knowledge of cause and effect, pre-emptive involvement in the criminal justice system runs the risk of accelerating criminal careers through association, while intervening too late can also result in escalation. In marked contrast, the only risk of early intervention with a nutritious diet is better health. Improving nutrition is very low risk.

New thinking is needed in understanding ways of helping young offenders control their violence. It is notable that based on our first study conducted between 1996-7 the average underlying rate of proven Governor adjudications was 9 per thousand man-days. Provisionally, that figure seems to be around 15 proven Governor adjudications per thousand man-days nowadays. Improving the diet has been shown to decisively reduce these rates. Our current study should be large enough to look specifically at violent incidents rather than just governor reports in general.

At a reception hosted by Minister Boateng and Lord Waddington, Officers who did a commendable job helping with the study at HM Prison Aylesbury reported that assaults against staff had fallen by 40 per cent during the study. Improving nutrition seems to provide a safer environment for staff.

There is provisional evidence that improved nutrition could decisively reduce incidents of suicide. Our current study will monitor self-harm in young adult male prisoners. Given the concerns set out in the Corston Report30, we would welcome the opportunity to expand this work to include female prisoners.

Evidently, the research on diet and behaviour to date has obvious utility across all prisoner populations

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29. Schoenthaler (1983) see n.16.
as they all have to eat. Improving nutrition is a positive approach and should complement existing approaches by providing a constructive platform for existing offender programmes to work better. The catering facilities are already in place to roll this out. There are already success stories such as Al Crisci who received a prestigious BBC award for the excellence of his catering at HMP High Down. These could readily be championed by HM Prison Service as an example of what is possible with catering alone.

The ideal is clearly to improve the diet consumed. The present study should tell us whether dosages achievable from diet alone are sufficient to produce maximal impact on behaviour. It should be noted that there is some evidence that providing too high a dosage of nutrients is as bad in behavioural terms as too little. Nevertheless, there may be a case for evidence based supplementation if it turns out that optimal dosages to impact behaviour are out of the reach of the catering provision, particularly for prisoners at higher risk of poor nutritional status such as those recently sentenced, juveniles and drug abusers. In our experience, once the prisoner feels better it becomes self-sustaining.

We would also advise that dietary education be rolled out to prisoners to teach them about the rudiments of selecting healthier diets.

There is evidence that physiological measures offer comparatively accurate predictors of violence. Low resting heart rate has been shown to correlate more strongly with antisocial and behaviours than social deprivation31. This effect predicted with 75 per cent accuracy which subjects would be incarcerated by the age of 29 in a 15-year longitudinal study32, and psychopathology and hostility in a 2-year longitudinal analysis of urban boys at risk of delinquency33. Our new study will assess heart rate variability as predictive risk factor for offending behaviours.

Physiological approaches have the advantage that they are more amenable to objective evaluation using double blind randomised studies. These are hard to conduct with social interventions. The authors suggest this is another reason for employing methods that can more readily be evaluated precisely.

Clearly, approaches that focus on causal factors are likely to be the most cost efficient and self-evidently this is a low cost approach. The Economist, of June 29, 2002, reported costs of the nutritional approach to be as little as 0.2 per cent of that expended on custody. In 2000 the Home Office asked us to develop estimates for how much it would cost to roll out the same intervention we used in our study across the prison estate. We estimated it would cost £3.5M per year for everyone in custody. Given the improvements in behaviour we demonstrated, we were told by the Home Office reviewer that they had nothing as remotely cost efficient. The authors are not aware what happened to this information subsequently. It would be straightforward to for us to reduce these costs further by developing an efficient system to deliver the same nutrients as an option at the servery instead of using capsules.

Our research has been entirely funded by the charitable sector with the exception of £1,000 provided by the Home Office. Unfortunately, despite its evident potential, this work has been held in abeyance. Unless someone senior is made responsible and accountable for overseeing such an introduction, any attempts to change the status quo are likely to remain piecemeal.

Conclusion

Nutrition is a meeting point of the physical and social worlds: the hardware and software of life so to speak, where both are required for social behaviour. The dietary approach to behaviour is simple, humane and evidently highly effective. It complements existing offender programmes. It is likely to be highly cost efficient and the only risk is better health. It is a most promising approach that has attracted one of the preeminent funding bodies in the world, The Wellcome Trust, to fund its development. This could comfortably place UK Prison Services in the forefront of this approach on a global basis. We hope that is an attractive prospect, and we urge those involved in prison management to embrace it and resist further prevarication. Given the probable benefits, it could make a major contribution to a healthy and peaceful society, inside and outside of prison.