Limitations

X A review is only as good as the original studies it uses: the researchers will have had no control over the ways in which each piece of research was carried out.

X PET scans cannot show DA as part of neurotransmission, they can only show which cells are more active in specific regions; therefore a cause-effect explanation cannot be made as to the exact function and activation of DA.

Reference

Volkow, N. D., Fowler, J. S., Wang, G. J., & Swanson, J. M. (2004). Dopamine in drug abuse and addiction: results from imaging studies and treatment implications. *Molecular psychiatry*, *9*(6), pp. 557.

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KEY STUDY: *Guo et al. (2014). Striatal dopamine D2-like receptor correlation patterns with human obesity and opportunistic eating behavior*

Brief Summary

Dopamine works in many areas of the brain and is related to pleasure, motivation, working memory, intelligence, and reasoning. However, it works in different ways in different parts of the brain. Opportunistic eating behaviour (eating not only when one is hungry but whenever food is available) and body mass index (BMI) are both positively associated with dopamine in the lateral striatum, whereas BMI is not associated with dopamine in the ventromedial striatum. The levels of dopamine were measured using binding potential of dopamine to receptors (D2BP).

Aim

To investigate the relationship between levels of dopamine in different parts of the brain and the current obesity epidemic.

Participants

Participants were 22 male and 21 female non-smokers between 18–45 years of age. Those with diabetes, recent weight change, a history of drug abuse, neurological, or psychiatric disorders (including eating disorders) were excluded. Women were excluded if they were pregnant, breastfeeding, or post-menopausal. 23 were non-obese, with an average body weight of 67.5 kg, and an average BMI of 22.4. 20 were obese, with an average body weight of 107.4 and a BMI of 36.1. Both groups were an even mix of male and female, but the obese group was older on average (35 yrs.) than the non-obese group (28 yrs.)

Procedure

All participants gave informed consent. Their body fat was measured, they completed the Three-Factor Eating Questionnaire (TFEQ) and had fasting blood tests for measurement of insulin resistance. The results of the questionnaire showed levels of opportunistic eating, with the higher score indicating the higher rate of opportunistic eating. They were provided with an energy-balanced diet and consumed all meals as inpatients at a health clinic for at least one day prior to measuring D2BP.

During this day, each participant underwent an MRI scan of the brain. On the following day, two hours after a standard breakfast, each participant had a PET scan of his/her brain. The PET scanning was carried out in 3 sessions over 3.5 hours.

Results

Mean measures	Non-obese (N=23)	Obese (N=20)
BMI	22.4	36.1
Caudate D2BP (dorsal)	24.9	28.2 (sig. correlation)
Putamen D2BP (dorsal)	27.0	30.7 (sig. correlation)
Accumbens D2BP (ventromedial)	16.7	18.3 (no sig. correlation)
Opportunistic eating	3.9	6.8

Opportunistic eating has been associated with obesity and these results show that opportunistic eating and obesity are positively associated with D2BP in the lateral striatum, a region that supports habit formation. Therefore, variations in dopamine neurocircuitry in the lateral striatum may play a role in the development of obesity by increasing a person's inclination to opportunistically overeat when food is freely available.

Another hypothesized role for dopamine in obesity centres on the theory that obese individuals overeat to compensate for reduced reward signalling in the brain. The results also offer some support for this theory, since the ventromedial striatum, and the nucleus accumbens in particular, is thought to support motivation to eat. The lack of positive correlation (and in some parts of the ventromedial striatum, a negative correlation) between BMI and D2BP here may reflect decreased reward signalling, which is a feature in common with addiction

Conclusion

These results suggest that obese people have alterations in dopamine neurocircuitry that may increase their motivation to overeat while at the same time making food intake 'less rewarding', 'more habitual', and less directed towards decreasing hunger.

Evaluation of Guo et al. (2014)

Strengths

- ✓ The research looked separately at both BMI and opportunistic eating, instead of assuming that one includes the other.
- ✓ The results were controlled for the age difference between the two groups.
- ✓ The findings could be used in therapeutic settings for treatment of obesity and overeating.

Limitations

- X This is a small study that only showed a correlation and therefore the results do not demonstrate a direct link between overeating and dopamine.

Reference

Guo, J., Kyle Simmons, W., Herscovitch, P., Martin, A. & Hall, K.D. (2014). Striatal dopamine D2-like receptor correlation patterns with human obesity and opportunistic eating behavior. *Molecular Psychiatry, 19* (10), pp. 1078-1084

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