Medical Research Archives

ESMED
European Society of Medicine

OPEN ACCESS

Published: October 31, 2022

Citation: Franchell Richard Hamilton, 2022. Baseline Body Mass Index Influences the Responses to Exercise Training on Quality of Life in Women with Obesity, Medical Research Archives, [online] 10(10). https://doi.org/10.18103/mra.v10i10.3242

DOI
https://doi.org/10.18103/mra.v10i10.3242

ISSN: 2375-1924

LETTER TO THE EDITOR

Neuroscience as the New Approach to Treating Obesity

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ABSTRACT

Obesity continues to be on the rise despite all of its advances in medications and surgeries, not to mention the invasiveness of the diet and fitness industry in this area. More than 72% of the U.S population is overweight or obese, and obesity is now rising in the pediatric population affecting our next generation. (1) Obesity on its own occupies a large part of health expenditures in the globe and has been the catalyst for over 200 other diseases identified. This chronic relapsing disease over time has been one of the most invasive to our nation and the most difficult to treat.

We have seen relapse rates from diet and medication over 90% and post bariatric surgery recurrence rates long term have been more than 70%. (3) The World Health Organization states that 2.8 million people die of obesity each year, a preventable disease. (4) Even when the name was changed several years ago by the American College of Endocrinology the epidemic continued to rise. At what point will the overseeing bodies decide that this is no longer good enough? As a bariatric surgeon, also board certified in obesity medicine, I am familiar with all the treatment algorithms for obesity and have practiced those for years. After seeing surgeries require 2 and 3 revisions due to weight recurrence I had to ask what was missing in the algorithm? After years of watching my patients struggle they answered that question for me. The addition of neurobehavioral science is what was missing.

Obesity is defined by the Obesity Medical Association as a "Chronic, relapsing, multi-factorial, neurobehavioral disease, wherein an increase in body fat promotes adipose tissue dysfunction and abnormal fat mass physical forces, resulting in adverse metabolic, biomechanical, and psychosocial health consequences." After treating obesity for over a decade I am convinced that obesity is predominantly a brain disease, a neurobehavioral disease that should be treated using neuroscience as part of the initial algorithm.

The parts of the brain that affect this disease the most are the reward pathways, the prefrontal cortex and the anti-reward pathway. Neuro-behavior mechanisms have been noted and documented since birth. Caregiving events in childhood could affect BMI and food habits. (5) Infants who are fed to soothe non–hunger-related distress, which may sometimes be driven by caregivers mistaking distress signals for hunger, are also perceived to have high responsiveness to food and may have a higher BMI. (5) This reward pathway starts very early, it is no wonder why in adulthood people can not change their behavior.
A reward pathway is a group of structures that gets activated whenever we experience something rewarding, like food or perhaps a drug. These stimuli release dopamine activating neurons along this mesolimbic pathway often referred to as the reward pathway.(6) There has been research on the idea of unconditioned motivated behaviors stimulated by dopamine release as a separate pathway from learned conditioned behaviors.(7) In western medicine our practice is guiding patients on goal-directed learned behaviors. This is the way we have been treating conditions such as obesity for years. We set goals, and recommend changed behaviors, and the patient is off with their prescribed regimen.
Weeks, months, or even years later depending on the prescribed weight loss regimen the patient is back with minimal success only to state their old behaviors have gotten the best of them.
Neuroscience has shown that it is habits, not cravings that drive food choices in times of stress or high pressure, which has been so prevalent and is seen in so many bariatric patients. (8) Recent research has defined a habit as a behavior that is repeated to a critical indicator of automaticity—an indication that the brain has recognized a repeated behavior and responded with myelination to make it faster and dominant. (9) Lifestyle change is based on habits, and habits are automatic behaviors. Our bariatric patients are going back into their unwanted behaviors because of the brain. Their pathways need changing or rerouting before their stomach gets rerouted.

The other area of the brain responsible for learning new behaviors and functions is the prefrontal cortex. The prefrontal cortex contributes to our executive control and has been named one of the most important areas in our decision making. Recent studies show the prefrontal cortex participates in decision making under free choice conditions.(10) This is the conscious part of our brain and takes a lot of focus and energy to use this area of the brain. In day to day tasks we actually use a small percentage of this portion of the brain compared to our subconscious portion, where everything is made to run automatically to preserve brain energy. (10) The prefrontal cortex dictates our cognitive control, but when we are stressed or tired this is the first to go offline and we fall back into default habits.

This explains why patients with a chronic condition have such a hard time not only learning a new behavior, but also why it is hard to maintain some of these behaviors and why they often even after surgery slip back into old habits that may not be helpful to their weight loss journey. Another question I often ask is why do people stop doing good behaviors? The answer lies in another area of the brain called the lateral habenula.

The brain also has what is known as a kill switch. The lateral habenula is responsible for stopping behaviors. The lateral habenula (LHb) is a phylogenetically primitive brain structure that plays a key role in learning to inhibit distinct responses to specific stimuli. (11) This structure is activated by primary aversive stimuli, cues predicting an imminent aversive event, unexpected reward omissions, and cues associated with the omission of an expected reward.(11) The most widely described physiological effect of LHb activation is acutely suppressing midbrain dopaminergic signaling.(11)

This is the part of the brain that remembered the pain when your finger touched the fire and makes you pull back your hand from the stove from now on. In other words, It remembers aversive events, it keeps track and when it perceives another event, it makes you stop.

This is what happens when behaviors are forced or perhaps prescriptive, as most patients have experienced in goal directed behavior models. The

person does a new behavior because they are told by their provider or instructor that these behaviors will achieve specific results or a specific goal, such as a loss of "x" amount of pounds or this A1c number, but they do not enjoy the process and even worse, they may not get the desired results. So in their brain, it is seen as a lose/lose. The brain keeps track of these events and when it perceives a similar situation, it forces a stop. For example, the patient did not like the cardio exercise prescribed and hurt their knees or how about the patient who could not do keto for longer than a month and felt like they were starving. These are examples of habenula events that will trigger the brain to make that behavior stop. Understanding the triggers that start or stop behaviors is imperative in healthy habit formation and sustainable change.

In conclusion there are three main areas of the brain that play a role in weight regain, obesity and behavior change: the mesolimbic system, the prefrontal cortex and the lateral habenula. With the rising obesity epidemic and all the research that has been done in neuroscience, It is in my opinion as a bariatric surgeon and weight loss expert, that our initial foundational algorithm should be treating obesity with a neurobehavioral approach first and the other tools that are used such as medication and surgery should come after the foundation has been laid. This would give us the best chance in reversing this chronic and invasive widely spreading disease.

1) Flegal, K. M., Kruszon-Moran, D., Carroll, M. D., Fryar, C. D., & Ogden, C. L. (2016). Trends in Obesity Among Adults in the United States, 2005 to 2014. JAMA, 315(21), 2284–2291. https://doi.org/10.1001/jama.2016.6458

2) De Lorenzo, A., Gratteri, S., Gualtieri, P., Cammarano, A., Bertucci, P., & Di Renzo, L. (2019). Why is primary obesity a disease?. Journal of translational medicine, 17(1), 169. https://doi.org/10.1186/s12967-019-1919-y

3) Velapati, S.R., Shah, M., Kuchkuntla, A.R. et al. Weight Regain After Bariatric Surgery: Prevalence, Etiology, and Treatment. Curr Nutr Rep 7, 329–334 (2018). https://doi.org/10.1007/s13668-018-0243-0

4) https://www.who.int/news-room/facts-in-pictures/detail/6-facts-on-obesity

5) Mallan KM, Sullivan SE, Susan J, Daniels LA. The relationship be- tween maternal feeding beliefs and practices and perceptions of infant eating behaviors at 4 months. Appetite. 2016;105:1–7.

6) Antonio Alcaro, Robert Huber, and Jaak Panksepp. Behavior functions of the mesolimbic Dopaminergic system. An Affective Neuroethological Perspective. Brain Res Rev. 2007 Dec; 56(2): 283–321. 10.1016/j.brainresrev.2007.07.014

7) Wise RA, Bozarth MA. A psychomotor stimulant theory of addiction. Psychol Rev. 1987;94(4):469–92.

8) Neal, D., Nathan G., (2013) Habits not cravings drive food choices. Institute of Food technologies, ScienceDaily. 16July

9) Busetto, L., Bettini, S., Makaronidis, J., Roberts, C. A., Halford, J., & Batterham, R. L. (2021). Mechanisms of weight regain. European journal of internal medicine, 93, 3–7.

10) *Shintaro Funahashi, Prefrontal Contribution to Decision-Making under Free-Choice Conditions. Front. Neurosci., 26 July 2017. https://doi.org/10.3389/fnins.2017.00431*

11) Rodrigo Sosa, Jesús Mata-Luévanos and Mario Buenrostro-Jáuregui. The role of the lateral Habenula in inhibitory learning from reward Omission. eNeuro 7 May 2021, 8 (3) ENEURO.0016-21.2021. https://doi.org/10.1523/ENEURO.0016-21.2021