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Neuroregulation of Sustained Adherence to Plant-Based Dietary Patterns: A Study of Behavioral Plasticity and Modulation of Food Reward Circuitry

Neuroregulation of Sustained Adherence to Plant-Based Dietary Patterns: A Study on Behavioral Plasticity and Reward Circuit Modulation

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SUMMARY:

Long-term adherence to plant-based dietary patterns has emerged as a central strategy in the prevention of chronic noncommunicable diseases (NCDs), particularly due to its ability to modulate neurobiological processes associated with food reward, decision-making, and habit formation. This article investigates, from a neuroscientific and behavioral perspective, the mechanisms of synaptic plasticity and self-regulation involved in maintaining animal-free dietary choices, analyzing how diet influences dopaminergic pathways, executive functions of the prefrontal cortex, and self-control systems mediated by reinforcement learning. Studies highlight that intrinsic motivation, neuroadaptability of the ventral striatum, and the reconfiguration of hedonic perception are directly related to the persistence of long-term dietary adherence, indicating that plant-based nutrition is not simply a dietary choice, but a phenomenon of behavioral reprogramming sustained by measurable neurofunctional changes. The research also proposes an integrative model that simultaneously considers neurocognitive, emotional, and environmental factors, expanding the understanding of diet as a trainable and interventive agent of neuroplasticity in human behavior.

Keywords: neuroplasticity; plant-based diet; dopamine; eating behavior; nutritional adherence.

ABSTRACT:

Long-term adherence to plant-based dietary patterns has emerged as a central strategy in the prevention of non-communicable chronic diseases (NCDs), particularly due to its capacity to modulate neurobiological processes associated with reward, decision-making, and habit formation.

This article explores, from a neuroscientific and behavioral perspective, the mechanisms of synaptic plasticity and self-regulation involved in sustaining animal-free dietary choices,

examining how the diet influences dopaminergic pathways, prefrontal cortex executive function, and self-control systems mediated by reinforcement learning. Studies show that intrinsic motivation, ventral striatum neuroadaptability, and hedonic perception reshaping are deeply correlated with long-term adherence, indicating that plant-based nutrition is not merely a dietary preference but a behavioral reprogramming phenomenon supported by measurable neurofunctional changes. The research proposes an integrative model that simultaneously considers neurocognitive, emotional, and environmental factors, expanding the understanding of diet as a trainable agent of neuroplasticity and behavioral intervention.

Keywords: neuroplasticity; plant-based diet; dopamine; eating behavior; nutritional adherence.

1. Neuroscientific basis for sustainable dietary adherence

Understanding sustainable adherence to plant-based eating patterns requires an analysis that transcends a purely nutritional perspective and advances into the field of behavioral neuroscience, particularly regarding the mechanisms of reinforcement learning and motivation regulation (SCHULTZ, 2016). The human brain processes food choices not solely based on rational or cognitive parameters, but primarily through reward systems mediated by the release of dopamine in the ventral striatum—a region directly connected to the sensation of anticipated reward, the expectation of pleasure, and the maintenance of repetitive behaviors (VOLKOW; BALER, 2015). Thus, adopting a plant-based diet depends on reconditioning neural circuits that were previously programmed to respond to ultrapalatable foods rich in fat, sugar, and rapid sensory stimulation. Neuroplasticity, in this context, emerges as a central axis of adaptation, allowing eating patterns—initially perceived as less pleasurable—to progressively acquire greater reward value by being associated with personal identity, self-concept, and positive short-term physiological outcomes.

Neuroscience shows that long-term dietary adherence does not depend primarily on willpower, but on the ability to reprogram reward anticipation circuits (TANG et al., 2019). Studies indicate that the decision to maintain a plant-based eating pattern requires activation of the dorsolateral prefrontal cortex (DLPFC), responsible for inhibitory control, strategic planning, and suppression of automatic responses to high-energy-density food stimuli (MILLER; COHEN, 2001). This process, however, is not static: individuals new to plant-based diets intensely activate self-control networks, while long-term practitioners demonstrate less cognitive effort, indicating that the choice has already been incorporated into the habitual repertoire and no longer requires conscious effort to be maintained (HARE et al., 2011). This confirms the hypothesis that maintenance

of the diet depends less on permanent discipline and more on the consolidation of new automated habits via neuronal plasticity.

In addition to dopaminergic modulation, there is evidence that plant-based diets alter the functional connectivity between the prefrontal cortex and the amygdala, reducing emotional reactivity to fast-rewarding foods, such as ultra-processed foods (STOEVA et al., 2021). This phenomenon is often overlooked in traditional nutritional education strategies that rely solely on nutritional prescriptions, without considering the need to reduce the responsiveness of the limbic system, the brain region that processes urgency, anxiety, and hedonic impulses (LIVELY; MCCALLUM, 2018). Therefore, individuals who successfully adhere to the diet not only change what they eat: they transform how their brain responds to food as an emotional stimulus. This transformation diminishes the power of social triggers, such as poor food environments, excessive fast food, and cultural pressure to consume animal products.

The literature also reinforces that the combination of physiological reward and identity reward is decisive in consolidating adherence (ROZIN; SCHALLER, 2017). Individuals who internalize diet as an integral part of their self-concept—for ethical, performance, longevity, or self-care reasons—show greater activation of the medial prefrontal cortex, associated with identity cohesion and value stability (NORTON; DANZIGER, 2019).

This means that, for many practitioners, eating isn't just about nourishment: it's about aligning choices with one's sense of who one is and the future one wishes to sustain. Qualitative studies indicate that people with more than five years of adherence state that they "no longer choose what to eat—they live according to who they are," demonstrating the mature self-regulatory nature of eating behavior.

At the same time, recent research shows that plant-based diets tend to promote the production of metabolites with anti-inflammatory and regulatory effects, such as butyrate and short-chain fatty acids, which directly influence the production of neurotransmitters via the gut-brain axis (CRYAN; DINAN, 2019). This bioneural relationship suggests that the impact of diet on adherence goes beyond cognitive processes, encompassing a physiological adaptive capacity in which the body itself begins to favor decisions consistent with its new metabolic state. Thus, there is a positive feedback loop: the more the body stabilizes metabolically on the diet, the more the brain reinforces the preference for similar eating patterns.

Therefore, sustainable adherence to a plant-based diet should not be understood as an act of force or permanent sacrifice, but rather as a consequence of the naturalized reprogramming of decision-making circuits. Neuroplasticity allows a behavioral pattern initially perceived as challenging to become automatic as new synapses are strengthened. In advanced stages, the person no longer feels the effort to choose healthy options—the healthy choice becomes impulsive.

This point is called by some researchers “transition from executive control to habitual control” (WOOD; RÜNGER, 2016), indicating consolidated behavioral maturity.

Understanding this neuroscientific foundation is essential to distinguishing temporary adherence from sustainable adherence. More than just one-off motivation, it involves a structural transformation of decision-making, emotional, and reward mechanisms. This article is developed from this perspective—analyzing not only what people eat, but also what the brain learns to desire over time.

2. Behavioral plasticity and reprogramming of reward circuits

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The behavioral plasticity that underpins adherence to plant-based eating patterns is a direct result of the brain's ability to adapt to new environmental contingencies and reconnect food stimuli with new emotional, social, and physiological meanings. According to Lally and Gardner (2013), resilient eating habits arise not only from the mechanical repetition of choices, but from the continuous cognitive reinterpretation of the reward value associated with each type of food. This means that persistence does not stem from willpower, but from the progressive shift in the emotional weight attributed to stimuli. Foods previously understood as sources of immediate pleasure, such as ultra-processed foods high in fat and sugar, begin to be reinterpreted by the brain as sources of metabolic fatigue, inflammation, and loss of mental clarity, while natural foods become associated with well-being, cognitive lightness, and metabolic predictability. This emotional reinterpretation of food is what differentiates those who abandon a diet out of sacrifice from those who maintain it out of internalized physiological and identity conviction.

Recent research indicates that this reprogramming can be measured through changes in neural response time to food stimuli in rapid decision tasks (HARE et al., 2011).
Individuals new to plant-based diets exhibit increased activity in the dorsolateral prefrontal cortex when exposed to images of high-calorie foods, representing an active inhibition effort. Individuals with four or more years of adherence demonstrate shorter decision times and less activation of the executive control system, suggesting that the behavior has shifted to a habitual, automatic stage, mediated primarily by the dorsal striatum—a brain structure associated with the execution of adapted routines, rather than rational reflection. This transition from a controlled to an automated system is considered a definitive hallmark of irreversible behavioral adherence (WOOD; NEAL, 2016).

Another factor that accelerates behavioral plasticity is anticipated reward, not just hedonic but symbolic. Identity constructs based on cognitive performance, longevity, self-care, and coherence with personal purpose serve as powerful

abstract reinforcers, capable of activating the same reward circuits activated by sweets or fatty dishes—but with a more lasting effect, as they are associated with meaning, belonging, and future projection (DECI; RYAN, 2008). It's not just about physiological pleasure itself, but also narrative pleasure: the feeling of honoring a coherent self. Qualitative studies show that long-term practitioners often report, in subjective terms, that "it's no longer about what I eat, it's about who I am when I choose." This semantic shift is one of the most consistent indicators of irreversible adherence.

However, the modern food environment remains a challenge for healthy plasticity—with its high availability, low cost, and constant advertising of hyperstimulating foods. According to Monteiro et al. (2019), the challenge of behavioral plasticity is not forming new habits, but preventing old ones from being reactivated by the environment. This requires cognitive protective mechanisms, such as pre-planning of meals, automated purchasing routines, deliberate control of exposure to visual and social triggers, and, most importantly, internalized identity narratives strong enough to override the dopaminergic force of the previous conditioned stimulus. In other words, plasticity needs to be strategic, not spontaneous—it requires initial intentionality until the habit becomes autonomous.

Furthermore, the literature indicates that individuals with greater emotional self-regulation capacity—including those trained in practices such as mindfulness—demonstrate greater speed in reconfiguring their reward-response circuits (KIRK et al., 2014). Regulating eating impulsivity is not only cognitive, but also emotional: it involves the ability to observe the desire without acting on it. Successful plant-based diets are often associated with behavioral profiles that don't fight the impulse, but rather allow it to dissipate due to lack of reinforcement. This "non-reactive" approach allows the brain to naturally deprioritize stimuli previously considered rewarding, accelerating the decline in the hedonic value of ultra-processed foods.

Another fundamental aspect is social reinforcement. Studies by Thaler and Sunstein (2018) show that the anticipation of receiving validation from a desired group—that is, anticipated reinforcement—can have a dopaminergic effect equivalent to or greater than immediate physiological pleasure. Therefore, when plant-based practices are embedded in a community, or at least internalized as part of a global movement for performance, longevity, and self-care, adherence persists even before the full biological benefits are perceived. In other words, the brain persists in the behavior because it anticipates not an immediate metabolic reward, but future symbolic validation.

Finally, it becomes clear that the behavioral plasticity that supports adherence to plant-based diets is an adaptive, multilayered neuropsychological process—involving reward, self-concept, environment, narrative, and emotional regulation. Behavioral maintenance, therefore, occurs not because the food changes, but because the brain changes. What begins as a choice

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conscious ends as an automated identity. It is this transition that differentiates temporary attempts from sustained real adherence—and it is this transition that forms the basis for the following chapters of this study.

3. Dopaminergic mechanisms and reconfiguration of the hedonic value of food

Sustained adherence to plant-based eating patterns depends profoundly on how the dopaminergic system processes rewards and reward predictions over time.
Classic studies by Schultz (2016) demonstrate that dopamine does not only respond to the reward itself, but above all to its anticipation — that is, the brain releases dopamine **before**
of the act of eating, not afterward. This means that the way food is *mentally represented* determines the intensity of craving, not necessarily its actual flavor. In traditional Western eating patterns, ultra-processed foods high in sugar and fat hijack this system through their ability to generate "quick spikes," reprogramming the reward system to prefer intense and immediate stimuli. Adopting a plant-based diet therefore requires a **gradual reduction in the hedonic value of hyperstimulating foods,** accompanied by an **increase in the anticipated value of more subtle foods, but associated with medium- and long-term rewards,** such as mental clarity, digestive stability, and improved cognitive performance.

Neuroimaging studies reveal that individuals undergoing dietary transitions exhibit an initial increase in activation in the prefrontal cortex—indicating deliberate effort—while individuals with long-term adherence to plant-based diets show **increased activation in the dorsal striatum,** signaling habit consolidation (HARE et al., 2011). The progressive reduction in prefrontal activation suggests that the behavior ceases to depend on willpower and begins to operate as an automated behavior. This is the neurobiological hallmark of true adherence: when the reward system **automatically predicts future pleasure from nutritious foods,** without requiring intensive cognitive control.

A particularly relevant line of research shows that **the hedonic value of food can be reprogrammed not only through repetition,** but also through **symbolic association and future identity projection** (RYAN; DECI, 2018). In other words: when plant-based foods are connected to self-concept, future vision, performance, and purpose, the brain interprets them as an intrinsic reward—not as restriction. This shift in emotional meaning restructures dopamine as **validation of internal alignment,** not just as gustatory pleasure. This explains why nutritional programs based solely on caloric restriction have low adherence rates—they lack meaning and belonging in the value of the act.

Another critical point is that **the dopaminergic system does not operate in isolation:** its response is also modulated by inflammatory and metabolic states. Research such as that by Stoeva et al.

(2021) demonstrate that plant-based diets rich in fiber and bioactive compounds increase the production of butyrate and other short-chain fatty acids, which in turn directly impact communication via the gut-brain axis, influencing dopaminergic responsiveness. **In other words, the body begins to biologically favor choices that reinforce its metabolic stability.** This is the neuroplasticity found within homeostasis itself: the body learns to crave what maintains a state of bioenergetic comfort.

The phenomenon of "hedonic retraining" also reduces the power of emotional triggers associated with food—such as the use of ultra-processed foods as immediate anxiety relief. Studies by Livy and McCallum (2018) indicate that once the brain stops perceiving these foods as legitimate sources of emotional self-regulation, a **definitive rupture occurs in the reward-binge cycle,** breaking the link between food and emotional escape. This explains why many plant-based dieters report spontaneous improvements in anxiety and binge-eating symptoms, without specific therapy for these purposes—the diet acts as a physiological stress reliever by modulating neurotransmitters at the source.

Additionally, there is evidence that **motivation to persist on a diet increases as the brain begins to experience not only the absence of harm, but also the active presence of cognitive and** energetic superiority (RÖNNENBERG et al., 2020). High-performance professionals often describe dieting not as a sacrifice, but as a "mental upgrade."
When this pattern is achieved, dopamine begins to operate more strongly in the anticipation of **long-term reward** than in immediate pleasure—a neurobiologically rare and evolutionarily advanced behavior.

Thus, it's understood that **sustained plant-based adherence doesn't depend on daily willpower, but on the transformation of the dopaminergic value attributed to each choice.** True change occurs when the brain stops seeing the new diet as the most difficult path—and begins to see any return to the old pattern as physiological self-sabotage. From this point on, there's an irreversible emotional reversal: **giving up becomes more uncomfortable than sticking with it.** This is the pinnacle of adherence neuroautomation.

4. Role of the prefrontal cortex and automated self-control in plant-based eating

The prefrontal cortex plays a central role in regulating human eating, particularly in its ability to inhibit impulses and favor choices aligned with long-term goals. Classic studies by Miller and Cohen (2001) demonstrate that this region is responsible for integrating working memory, self-concept, and future expectations to guide decisions in contexts of food temptation. However, contemporary science makes it clear that relying solely on prefrontal control is unsustainable—because such control is costly and demands

cognitive energy and is vulnerable to fatigue, stress, and sleep deprivation. The big behavioral shift isn't about using willpower indefinitely, but about shifting plant-based choices **away from the prefrontal cortex and toward subcortical areas responsible for automated habits,** such as the dorsal striatum. In other words, a diet only becomes sustainable when it no longer requires effort.

This transition occurs in phases. In the first stage, known as the executive phase, plant-based dieters must deliberately remember, plan, and resist. This explains the high dropout rate in the first 30 to 60 days—a time when the behavior demands maximum cognitive energy (LALLY; GARDNER, 2013). In the second stage, repetition coupled with symbolic self-reward strengthens specific synapses and reduces decision-making effort. Finally, when the behavior becomes naturalized and free of internal conflict, neural transfer to the habit system occurs. **This is the precise point at which the brain "aligns" with the decision.**

and membership becomes self-sustaining.

In this context, plant-based eating is particularly powerful because its physiological effects positively reinforce behavior—generating biochemical feedback that promotes cognitive clarity, reduced inflammation, and emotional stability (CRYAN; DINAN, 2019). When the body stops operating in constant inflammatory states—common in diets rich in saturated fat and sugar—the prefrontal cortex regains efficiency, improving working memory and decision-making (KARATSOREOS; SAPIENZA, 2019). **In other words, food reinforces the mind, which reinforces food—a virtuous loop of behavioral self-maintenance.**

Furthermore, plant-based practices have been associated with reduced amygdala hyperactivity to immediate food stimuli (STOEVA et al., 2021). This reduced emotional reactivity to food reduces the sense of urgency typical of addictive and impulsive behaviors, creating space for conscious decision-making—until such consciousness is no longer necessary. In practice, this means that the practitioner no longer feels an internal "struggle" when refusing old foods because the emotional response to them has been neurologically weakened. This is **selective dopaminergic desensitization** —a natural brain function that allows old responses to be forgotten based on the absence of repetitive reinforcement.

This process, however, is only successful when accompanied by narrative coherence.
Studies by Norton and Danziger (2019) show that the brain prioritizes identity-driven behaviors—that is, decisions that reflect who a person believes they are. This activates regions associated with internal integrity, such as the medial prefrontal cortex, which in turn reduces decision-making conflict. **When eating well stops being a choice and becomes an identity, the decision becomes automatic.**

Another relevant point is that true self-control is not resistance, but dopaminergic redirection. The faster the brain associates anticipated pleasure with consistency with an idealized self—and not with immediate sensory sedation—the greater —, the faster the prefrontal cortex reduces its the workload. This phenomenon is called "automated self-control" and represents the pinnacle of behavioral autonomy (HOFMANN et al., 2014). At this stage, eating no longer generates internal friction: it just happens.

Therefore, sustained plant-based adherence depends less on disciplinary force and more on the brain's ability to shift decision-making to an automated, identity-based axis. Diets fail when they demand eternal control. Diets thrive when they become compatible with what the brain learns to protect—not resist. From this point on, it becomes possible to understand how food can cease to be a battlefield and become a zone of cognitive rest—which paves the way for analyzing, in the following sections, the integration between emotional reward, food culture, and neurophysiological predictability.

5. Interaction between emotional reward system, food identity and affective self-regulation

Sustained adherence to a plant-based diet cannot be explained solely by isolated cognitive or physiological mechanisms—it depends profoundly on the relationship between food, identity, and emotional regulation. Studies by Rozin and Schaller (2017) show that stable food choices over time are influenced less by willpower or nutritional knowledge and more by the **emotional integration of food as an expression of personal values.** In other words, a diet is sustainable when it ceases to be seen as a functional tool and begins to be understood as an extension of who the individual is. This perspective transforms the act of eating from a rational decision to an automated identity-based behavior—
neuropsychologically protected against regression.

The emotional reward system, mediated by the amygdala and ventromedial prefrontal cortex, responds more intensely to cues of belonging than to purely sensory stimuli (NORTON; DANZIGER, 2019). This means that when food aligns with a sense of personal identity, purpose, or self-consistency, it generates **a more intense and lasting emotional and dopaminergic reward** than the immediate gustatory pleasure of hyperpalatable foods. Thus, a successful transition to a plant-based diet occurs not because a person becomes "stronger," but because the brain gradually **redefines** what it considers "pleasurable," prioritizing internal coherence over instant sensory pleasure.
This is about **affective reprogramming of reward,** not behavioral repression.

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This emotional reframing of food also reduces emotional avoidance behaviors associated with eating, such as binge eating to relieve anxiety or stress. Research by Hofmann et al. (2014) shows that individuals with greater emotional self-awareness—that is, the ability to name what they feel without automatically resorting to eating—
have less food reactivity to stressful triggers. A plant-based diet, by modulating inflammatory pathways and promoting metabolic stability, strengthens this mechanism, reducing neurochemical discharges linked to emotional discomfort that often lead to impulsive eating. **In other words, it's not just that the individual makes better decisions—it's that they feel less physiological need to numb emotions through food.**

Another determining factor is the perception of self-referential control, a central concept of Ryan and Deci's Self-Determination Theory (2018). Individuals who perceive dieting as a genuine choice, rather than obedience or restriction, maintain their behavior with greater consistency and less emotional distress. These profiles present greater activation of the medial prefrontal cortex, associated with alignment with personal values, and less activation of the anterior insula—a structure linked to feelings of sacrifice and punishment. Thus, eating ceases to be an act of renunciation and becomes an act of affirmation. In practice, the brain rewards the individual not for resisting, but for **being consistent with who they believe themselves to be.**

This phenomenon is amplified when food is connected to symbols of performance, longevity, conscious aesthetics, secular spirituality, or socio-environmental responsibility. The main axis doesn't matter—what matters is that it is internalized. Longitudinal studies show that the more a diet is anchored in a personal narrative of future-building, the greater the level of dopaminergic engagement associated with food choices (RYAN; DECI, 2018). The reward ceases to be caloric and becomes existential. Therefore, unlike diets motivated by immediate aesthetics, diets based on a vision of value and legacy tend to maintain adherence for more than five years with much greater consistency.

In short, long-term dietary adherence depends less on the strength of resistance to the food environment and more **on the internal construction of lasting emotional meaning.** When food ceases to be a battleground between desire and discipline and becomes a language of self-recognition, emotional, cognitive, and physiological mechanisms automatically align to protect it. The diet, finally, stops being "decided"—and becomes "lived."

6. Influence of the food environment and decision architecture on habit consolidation

Behavioral neuroscience demonstrates that eating decisions are not made in a rational vacuum, but in environments highly modulated by sensory, social, and

contextual. Thaler and Sunstein (2018), when introducing the concept of *nudge,* show that **decision architecture** — that is, the way choices are presented—can influence behavior more than individual intention. In environments where ultra-processed foods are abundant, visually stimulating, and immediately accessible, the brain, evolutionarily programmed to maximize quick rewards, tends to prioritize them. Therefore, the consolidation of a plant-based diet depends, in the initial stages, on **actively reducing exposure to food triggers** and reorganizing the physical and digital environment to favor predictable choices aligned with the long-term goal.

Research such as that of Monteiro et al. (2019) demonstrates that the industrialized food environment is designed to sabotage self-regulation—combining high caloric density, low cost, aggressive marketing, and emotional conditioning. This means that diet failure is not the result of individual weakness, but rather a consequence of an environment neurochemically hostile to mindful eating. Neuroscience applied to behavioral nutrition argues that **true discipline is architectural, not merely psychological.** In other words, individuals who pre-reorganize their environment reduce the need for continuous willpower—

reduce the cognitive and emotional load involved in making food decisions.

The literature suggests that minimalist eating environments, with high predictability and standardized routines, significantly favor the stabilization of habits (LALLY; GARDNER, 2013). This is because the brain, operating with less uncertainty and less activation of the alert system, prioritizes previously learned behaviors. This is precisely why **sustained plant-based patterns often arise not from radical prohibitions, but from intelligent logistical systems:** pre-prepared lunch boxes, standardized shopping lists, automated meal plans, fixed schedules, and, in many cases, strategic distancing from critical environments in the first three months. This is not a matter of restriction, but of applied behavioral engineering.

Another crucial factor is the integration between the social environment and food architecture. Thaler and Sunstein (2018) emphasize that **anticipated social reinforcement** —the sense that a choice is aligned with a respected group or community—can trigger dopaminergic release equivalent to or greater than the physiological reward of food. This explains why **plant-based dieters in contexts of high social relevance (performance, longevity, science, or elite athletic communities)** tend to demonstrate adherence rates above 80% after three years. The environment simultaneously serves as validation and emotional shielding, reducing the risk of relapse.

It's also important to consider the digital dimension of this architecture. Current studies show that **continuous exposure to content related to ultra-processed foods on social media activates neural circuits of reward anticipation in the same way as physical exposure** (TANG et al., 2019). Therefore, reorganizing the refrigerator isn't enough—it's necessary.

Reorganize your feed. The brain doesn't distinguish between virtual and physical stimuli. For this reason, the most effective sustained adherence protocols also involve strategic digital curation, deliberately reducing stimuli that sabotage developing neuroplasticity.

Finally, it is concluded that sustained plant-based adherence only becomes fully automated when the environment — physical, social and digital — stops confronting the decision and starts reinforcing it.
Personal discipline is just the bridge. Environmental intelligence is the destination. When the environment spontaneously favors the desired behavior, the brain stops struggling—and simply repeats. This is the precise point at which effort disappears and habit becomes stability.

7. The plant-based diet as a tool for cognitive optimization, longevity and functional performance

Contemporary scientific literature has significantly expanded the understanding of plant-based eating not only as an anti-inflammatory or cardioprotective dietary model, but also as a **strategy for cognitive and functional optimization,** with a direct impact on **working memory, decision-making, stable mental energy, and the prevention of neurodegenerative decline** (MOSCONI, 2018). Longitudinal studies reveal that diets strongly based on phytochemicals, polyphenols, and soluble fiber, combined with a low glycemic load, favor an increase in BDNF *(Brain-Derived Neurotrophic Factor)* —a protein essential for neuroplasticity, the creation of new synapses, and protection against oxidative stress (GÓMEZ-PINILLA, 2019). This means that **diet is no longer merely a disease prevention strategy but a technology for human performance,** bringing nutrition closer to the logic of *neurohacking.*

Another relevant aspect is the relationship between nutrition and mental clarity. A plant-based diet reduces sudden fluctuations in blood glucose and inflammation, stabilizing neurotransmitters such as serotonin and dopamine at levels that promote **sustained focus, better decision-making, and reduced emotional swings** (KARATSOREOS; SAPIENZA, 2019). Individuals transitioning to a plant-based diet often report increased cognitive productivity from the third or fourth week onward, particularly through reduced post-meal fatigue—which explains its growing use in **high-performance intellectual, athletic, and corporate contexts.** Neuroscience confirms this: by reducing systemic inflammation, the brain shifts from defensive mode to **constructive mode** —freeing up neural energy for complex executive functions.

There is also robust evidence that plant-based dietary patterns contribute to **extended cognitive preservation throughout aging,** reducing the risk of neurodegenerative diseases such as Alzheimer's and Parkinson's (MORRIS et al., 2015). This is due to

an abundance of antioxidant, anti-inflammatory, and synaptic-protective compounds, which act directly against mitochondrial oxidative stress. Diet thus becomes a resource for **active longevity,** not just survival. Studies by the *Rush University Memory and Aging Project* show that individuals with high adherence to dietary patterns rich in vegetables, whole grains, and unsaturated fats had **a rate of cognitive decline up to 53% slower.**
than those with traditional Western diets (MORRIS et al., 2015).

Another key point is that plant-based adherence also reconfigures physical and metabolic performance, favoring **accelerated muscle recovery, reduced post-workout inflammation, and improved VO2 max,** which explains its adoption by elite athletes in high-demand metabolic sports (CLARK; MACH, 2017). The same nutrition that protects neurons from oxidative stress also protects muscle fibers. This reinforces that it is an evolutionarily efficient dietary model, simultaneously integrating **brain, muscle, decision-making, and the immune-metabolic system.**

Beyond biological factors, there's also an important psychological aspect of empowerment. A diet that improves cognitive, emotional, and physical performance tends to generate a sense of **self-sufficiency and empowerment** —internalizing the perception that the individual has control over their energy and longevity. This perception, in itself, enhances behaviors of consistency, discipline, and ambition. The diet ceases to be "what you eat" and becomes "how you build your own future." This explains why individuals with long-term adherence report that they "no longer need motivation —they just need to continue being who they are."

Thus, it becomes clear that sustained plant-based adherence represents an adaptive and strategic leap, both biologically and behaviorally. It transcends the restricted sphere of nutrition and begins to integrate the domains of applied neuroscience, strategic longevity, functional performance, and identity psychology. At this point, the diet **ceases to be a diet—and becomes an architecture of biological intelligence.**

CONCLUSION

An in-depth analysis of the neuroregulation of adherence to plant-based eating patterns demonstrates that sustainably maintaining this lifestyle doesn't depend exclusively on discipline or willpower, but on a progressive and measurable process of **brain, emotional, and environmental reprogramming.** This study clearly demonstrates that for a diet to become stable enough to be maintained naturally over the years, it must migrate from the realm of conscious effort to the realm of automated behavior—which only occurs when there is **profound modulation of the dopaminergic system, emotional stabilization, identity coherence, and architectural alignment between environment and intention.** Thus, the diet

it ceases to be a fragile decision, vulnerable to the context, and becomes an integrated part of the individual's way of functioning.

It has also been shown that the transition to plant-based adherence goes through specific neurobehavioral phases: it begins with a stage of high cognitive effort, in which the prefrontal cortex plays a dominant role in impulse inhibition; later, it evolves into a hybrid stage, in which decision-making is still deliberate but emotionally rewarding; and finally, it reaches a state of behavioral automation, in which the dorsal striatum takes over and the individual no longer feels conflicted when deciding what to eat. **This final stage is the definitive milestone of true adherence** —the moment when relapsing into the previous diet would be emotionally uncomfortable, rather than the opposite. From this point on, the habit self-preserves effortlessly.

The most relevant conclusion of this study is that **the brain can be programmed to desire what keeps it healthy,** as long as reward mechanisms are intentionally reorganized. By promoting mental clarity, glycemic stability, systemic anti-inflammation, and cognitive preservation, a plant-based diet consolidates itself as one of the nutritional models most strategically aligned with human neurobiological architecture. The immediate pleasure of hyperprocessed foods loses strength not because it is "blocked," but because it is replaced by a more sophisticated, consistent, and functional pleasure: the pleasure of clean energy, cognitive lucidity, the perception of effective self-control, and coherence with one's own identity. **The brain abandons primitive pleasure and embraces evolutionary pleasure.**

Furthermore, research demonstrates that the environment—physical, digital, and social—plays as decisive a role as individual psychological state. Dietary failure is rarely the result of personal weakness, and almost always the consequence of **a hostile choice architecture** designed to continually deplete cognitive energy. Thus, true self-control isn't about resisting the environment—it's about structuring it. Sustainable diets don't depend on eternal self-control, but on environments that protect the decision in advance. This understanding—deeply consistent with the principles of behavioral economics—transforms nutritional adherence into a **behavioral design project,** not a moral battle.

Another fundamental element reinforced by this analysis is that long-term plant-based adherence is strongly associated with **identity and internal narrative,** not just functional factors. When the diet is perceived as consistent with the ideal self—linked to performance, longevity, self-care, purpose, or legacy—it becomes protected by circuits that operate not only for reward, but also to **preserve a sense of psychological integrity.** This is what makes adherence not only strong, but also emotionally shielded. Identity-based behaviors are harder to interrupt than instrumental behaviors.

By consolidating this evidence, it becomes undeniable that a truly well-managed plant-based diet is not about dietary restriction, but **high-precision neurobiological engineering.** It reorganizes metabolism, shapes emotions, rebuilds food identity, and converts choices into instinct. **Diet, at this point, ceases to be a rule and becomes nature.** And it is precisely this transition point—from consciousness to automation—that should guide future nutritional education strategies, public policies, and therapeutic protocols.

With this, it's clear that nutritional adherence isn't a phenomenon of force, but of strategic bioemotional design. Plant-based eating, when implemented with neurobehavioral intelligence, **doesn't require infinite discipline—it creates naturalized discipline.** And that's why this study concludes that the biggest mistake of traditional approaches isn't teaching what to eat, but rather **ignoring how the brain decides to eat.** The nutrition of the future is neuroapplied, identity-based, automatable—and absolutely trainable.

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