Viewpoint: Sugar Stress: How Our Diet Impacts Vision and Development

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Abstract

Our food and eating habits have changed dramatically over the last many centuries. We are eating far more sugar and refined carbohydrates than ever before. This has a negative influence on our general health. This article will go beyond general health, and address how these nutritional changes, through the body's stress responses, affects our behaviour and vision. The topic of diet should be a natural part of the examination by developmental optometrists.

Key Words

behaviour, primitive reflexes, stress, sugar, vision

Our diet has changed considerably over the past decades and consists of more refined foods with higher sugar contents and lower levels of important nutrients than ever before. This unfortunate combination not only affects our biochemistry and health, but also our ability to learn, our behaviour, and our vision. About 10,000 years ago, humans began to gather and grow grain. Since that time, our diet has gradually changed to be made up of increasing amounts of refined carbohydrates.[1]

Over millions of years, humans have evolved genetically to live on a combination of unrefined plant foods, meat, fish, and eggs, all of which are found easily in wild nature. When we ate that way, there was a good balance between carbohydrates (sugars) and the vitamins, minerals, and other important enzymes naturally present in plants. This balance is quite delicate, and as such, it doesn't take much to disrupt it. Vitamins, minerals, and enzymes found in whole plants are absolutely necessary both to break down and convert the carbohydrates, proteins, and fats we eat, and for other bodily functions. When we eat whole plants, there is a natural balance between the sugars and the nutrients needed to convert those sugars into energy in our cells. Over the last 100 years, the food industry has caused an increased refinement of our diet. To a much higher degree than ever before, we process our food and sort out the nutrient dense part of the plants, leaving only the sugar and the starches. This reduces the dietary content of the important essential nutritional elements, and causes our biochemistry to get out of balance. Because of this, our body cannot optimally transform and neutralize the foods we eat in our diet.

Another negative impact on our body when we eat refined carbohydrates and sugar is the fast rise in blood sugar. Since the glycemic index is much higher in sugars and refined carbohydrates than it is in whole plants/whole food, the former causes greater fluctuations in blood sugar. The higher the glycemic index, the faster sugars are absorbed in the blood, and the more stress they cause on our hormone glands.

Over the last 50 years, there has been a significant change in the volume of white bread and sugar in our diet. Rolls, bagels, pizza, pita bread, and other bread products have become commonplace. This development has been at the expense of the coarser and healthier foods.

When we refine and process plants to have a lower content of fiber and essential nutrients, it can cause both acute and longer-term problems. Two such problems are:

1. Large fluctuations in blood sugar which could be reflected in stress responses, behavioural problems, and fatigue.
2. Depletion of vitamins, minerals, and other essential nutrients; and indigestion that diminishes our energy production and health.

The natural stress response

The human body basically has two types of metabolism:

1. The economic metabolism (also termed fat-burning metabolism), where glucose is slowly released from the liver. The liver transforms complex carbohydrates, fat, and proteins into glucose, and releases it in a steady slow stream into the blood to give a sufficient and stable energy level.
2. The stress metabolism (also termed the sugar-burning metabolism), where depots of glucose are released from liver and muscles, to provide an instant explosive energy.

The economic metabolism is supposed to be dominant most of the time to save energy. It is what we used in ancient times while wandering around searching for food and doing constructive things. It is what we need today for academic learning and planning. It is supposed to be dominant while we are in peaceful situations. The stress metabolism becomes dominant when we face a situation that requires action. This increases our abilities to react and puts us in a better position to flee or to stay, and fight the danger that threatens us.

Stress triggers an acute high blood sugar, parallel with an increased production of stress hormones and insulin. In the past, the main reason for the large blood sugar increase was to allow the person to meet stressful situations. Today, we get large blood sugar fluctuations from eating sugar, white bread, and other refined carbohydrates.

Unfortunately, the body's biochemical response to elevated blood sugar is close to the same whether it is triggered by a natural stress response or caused by refined foods. A diet rich in refined food, or just a little candy or soda, triggers a stress-related biochemical reaction in the body.

Glucose sensitivity

Individuals metabolize their food at different rates. For discussion purposes, we will talk just about fast and slow types of metabolism. Children and adults with a fast metabolism, and especially those who have a stress-related fast metabolism, are often sensitive to sugar and simple carbohydrates (refined carbohydrates).[2] A rapid increase in blood sugar triggers a stress-related biochemical reaction that reinforces their fight or flight response. This can result in hyperactivity or aggressive behaviour.

My clinical experience with children who have behaviour problems and/or hyperactivity, ADD (attention deficit disorder), or ADHD (attention deficit hyperactivity disorder) is that they do much better if they are completely cut off from sugar, sweets, and other refined carbohydrates. Many of them will develop perfectly normal behaviour without any other treatment.[3] Almost all of these children will be helped by a change of diet combined with neuro-developmental visual therapy, which includes integration of the primitive reflexes.

The rationale for this is that children with poorly integrated primitive reflexes have a dominant Moro reflex. The Moro reflex is supposed to call for attention in danger and to start the fight or flight response. When the Moro reflex is poorly integrated, it can be triggered by even the slightest sensory impression, including a sudden increase in blood sugar level.

The acute reaction caused by eating refined carbohydrates when you have glucose sensitivity is therefore an acute stress reaction. This is often reflected in behaviour and attention. If this reaction is triggered repeatedly, or for that matter, is kept in a state of being constantly triggered so that the sympathetic nervous system (fight or flight) too often or for too long is dominating, it will affect digestion and body energy turnover negatively.

When the sympathetic nervous system is dominant, our digestion and nutrient uptake is reduced. This is because the body does not expend energy on digestion when we are in the stress mode and prepared for fight or flight. When the stress response is triggered from eating refined carbohydrates that are depleted of essential vitamins and minerals necessary for our metabolic processes, it will reinforce the negative effect on our nutrition uptake and energy production.

The effect of sustained stress response triggered by refined carbohydrates is that in the long run we cannot meet the energy requirements of our adrenal glands. This means that we have an inadequate energy-to-stress ratio. This is also called adrenal burnout. When that occurs, our metabolism often decreases and we can develop sugar intolerance.

Sugar intolerance

Persons who have a low metabolic rate who are exposed to sugar stress can have difficulties converting sugar into energy and many turn it into fat instead. The result is decreased energy and weight gain.[4] At the same time, the person experiences a craving for sweets. This is related to the poorly generated energy and because sugar, when present, does not give a sensation of satiety. A person with sugar intolerance experiences fatigue and hunger soon after eating carbohydrates regardless of the source.

Glucose sensitivity and sugar intolerance are two modes which are highly intertwined and rarely seen in isolation. For the sake of simplicity, we can say that people with a fast metabolism usually respond with hyperactivity when they eat sugar (sugar sensitivity), while those with a slow metabolism often react with fatigue and tendency to gain weight (sugar intolerance). Both conditions can cause an almost obsessive desire to eat sweets.

Moro reflex and sugar stress

Since both a normal stress response and sugar stress have roughly the same biochemical reaction, a person who has a dominant Moro reflex is at risk of developing glucose sensitivity and sugar intolerance. The Moro reflex is innate and triggers our attention in the neonatal period. When infants experience a change in stimuli in one of their senses above a certain threshold, it triggers the stress response. The baby reacts with a little twitch and its attention, by reflex, is stimulated in the direction of the triggering impetus. When someone approaches the crib where the child is located, this triggers a Moro reaction. The Moro reaction is also triggered if you suddenly start to talk to the child or suddenly touch them.

The Moro reflex is essential for the child's alertness and attention as long as it is reflex-driven. But as the child becomes increasingly more aware and cognitively driven, the Moro reflex becomes a disturbing motor action if not integrated. A person with an incomplete integration of the Moro will overreact to sensory input, especially sudden sensory input that will trigger stress hormone release from the adrenal glands and thus the dominance of the sympathetic nervous system.

A person with a deficient integration of primitive reflexes, exposed to frequent and sometimes constant changing sensory input, will live in a chronic fight-or-flight response. This can cause glucose sensitivity and sugar intolerance. If such individuals consume food or candy that increases blood sugar levels, it will amplify reactions of the primitive reflexes. They are therefore more sensitive to high blood sugar fluctuations – they have glucose sensitivity.

Children with fast metabolisms who eat a breakfast rich in refined carbohydrates (white bread, corn flakes, most cereals, jams, etc.) and/or sugar will come to school with a dominating sympathetic nervous system and an energy level that makes them hyperactive. Those children are ready for action, both energetically and sensorially. When they are in fight-or-flight mode, their senses are attending outwards, and they get in trouble trying to sit still and trying to focus at the reading distance.

Our accommodation and convergence will be pushed out at distance by the dominance from the sympathetic nervous system, and it will require extra cognitive control to keep the accommodation and convergence at the distance of reading.

This requires a higher level of conscious control thus it will affect reading comprehension.

Many children who have inadequate integration of their primitive reflexes do not have the cognitive skills to master conscious driven control, and their reaction will often be interpreted as inattention. Actually, they are too attentive to the surroundings instead of being focused on the task. Even with a good diet, exclusive of unrefined food, children with a dominant Moro reflex have great difficulty in controlling their fight-or-flight response in order to stay focused. These children often develop a controlled "myopic" behaviour. However, under the influence of sugar or abundant refined carbohydrates, the control may be impossible and their stress response forces them into hyperactivity, ADD, and ADHD behaviour. When we discuss a controlled or uncontrolled stress response, the difference is very often the metabolism and the degree of glucose sensitivity.

Visual behaviour and sugar

Accommodation/convergence involves the interaction between our cognitive, the automatic, and autonomic motor systems. If the sympathetic nervous system is dominant, it will attempt to adjust our eyes to look at distance, regardless of whether it is triggered by a real stress response, a poorly integrated Moro reflex, or a sudden high blood sugar caused by sugar intake. When this happens, accommodation decreases and the focus will be set at distance. If this reaction occurs while we try to read or concentrate on work at near, it requires a significantly increased volitional (cognitive) control to keep the attention on what we read. To keep the text clear while reading, we must increase the pull on our external ocular muscles (to increase convergence). Therefore, a conflict arises between the cognitive and the reflex related motor functions.

People with good energy resources and well-developed cognitive skills may retain control, but with increased tension in the extraocular muscles. Those with low energy or low cognitive drive will more often lose focus on the task and get distracted. They may also be inattentive and lose concentration.

These two different ways to respond will eventually show up in various vision problems. The child who retains control and focus may develop a high muscle tone of the external eye muscles (esophoria) and an increased risk of developing myopia, while the child who loses focus often does not develop vision problems. Their visual system remains unchanged because it has not been controlled against the stress response yet.

Reactions to visual near stress

Visual stress can occur through intense and sustained visual tasks at near. A person who is well integrated neurophysiologically will handle the near work significantly better than the person who has poor integration. The well-integrated will often be able to cope with persistent near work for a longer period without developing compensatory visual functions such as esophoria, myopia, astigmatism, or suppressions. The poorly integrated will either be in the flight mode and avoid near work or stay engaged. Those who go into flight and avoid near work normally do not show any compensations in visual analysis, whereas those who stay on the task will have to build some kind of compensation to the stress.

All motor functions can be fatigued and thereby reach a point where function is affected. A well-integrated person, who has developed a good integration between the motor system and the autonomic system, is working under much less stress and uses significantly less energy to see than a person who is inadequately integrated. Large fluctuations in the blood sugar level have the same effect as stress. Secondarily, a person with large blood sugar fluctuations will experience increased stress responses and more near stress. A diet rich in sugars and simple carbohydrates can cause even a person who is neurophysiologically well-integrated to behave similar to a person with a poor neurophysiological integration. Sugar and simple carbohydrates increase the stress response and the demand for more energy and more voluntary muscle tension while doing near work to balance the increased activity from the sympathetic nervous system. Those who have the energy and drive to take this fight (the fighters), will persist doing their near work and will be at risk for developing compensations or suppressions to maintain the ability to see at near. This can happen in spite of the fact that they may be well integrated. Those who do not have this energy or drive, but who have the flight response, often give up sooner, and because of that do not develop compensations or suppressions. The later group is often described as "visual virgins."

Stress reducing reading glasses

Glasses with low powered plus lenses may shift the balance between the dominant sympathetic nervous system and the voluntary motor system so that reading becomes more effortless. This works in the sense that it requires less engagement from the cognitive motor system when the optimal lenses are used. Glasses do not solve the problem, but do support a better balance.

For people who are well integrated, these lenses may increase endurance and concentration and improve the ability to work at near without developing compensatory visual functions. People with inadequate integration, on the other hand, may be helped to the point where they can start to keep attention, focus, and concentration on near work. With assistance, they can begin to engage in near work, but still under stress. The stress reducing lenses change their behaviour from flight to fight. Since they start to engage in more demanding and stressful tasks, these individuals often begin to develop compensatory visual functions such as esophoria, myopia, astigmatism, anisometropia, or suppression tendencies.

People who are well integrated, but exposed to high blood sugar fluctuations, either due to stress or as a result of eating refined carbohydrates, can react the same way as people who are not well-integrated. This is because stress and high blood sugar fluctuations both can generate stress responses. Therefore, people who consume many refined carbohydrates expose themselves to developing compensatory visual dysfunctions.

Visual therapy

Traditional visual therapy based on anti-suppression and convergence/accommodation techniques teaches patients to control the reflex induced ocular functions through the conscious motor system. This can be of great immediate benefit. Individuals who get this immediate help often come back later with other problems. These problems are often of compensatory in nature and may occur both as refractive changes

such as myopia or more general muscle tension, including hypertonicity of the muscles in the neck.

Those who develop compensatory visual features frequently end up accepting restrictive visual features (reduced visual acuity) or receive compensatory glasses. Those who do not develop compensatory visual features very often avoid reading, or if they are forced to do near work, present with various complaints such as headache, neck tension, general fatigue, and a number of more diffuse complaints. These people almost always have insufficient integration of their innate primitive reflexes.

Vision training builds ocular function and allows individuals to achieve smooth and relaxed visual features so they can reach their full potential. This necessitates the integration of basic neurological functions such as primitive reflexes and vestibular/motor/visual integration.

Motor integration activities.

Any therapy that works at a higher level of development than the patient's underlying motor integration will in my view cause compensatory behaviour. All therapy must be based with respect to their neurophysiological development.

Development of motor control proceeds from top to bottom and inside to out. We first have to develop control of head/neck/torso, upon which later control of arms, lower body, and legs is built. Poor head control will result in poor posture, motor perception, vestibular integration, and balance. It is important to develop good gross motor perception and control before starting to work on the vestibular/motor/vision integration. Vestibular integration should not be built on weak motor perception. Proper gross motor perception and control, free from the interference from the primitive reflexes, should be developed before or together with vestibular integration in order to develop free and effortless fine motor control and perception.

Eye functions are fine motor and are dependent on vestibular integration. Visual therapy comprised of eye exercises alone, leads to compensatory tensions if the underlying areas are not sufficiently developed.

Conclusions

Biochemical imbalances, especially glucose sensitivity and intolerance, affects energy and stress ratios in a way that will be reflected in the patient's behaviour, motor control, and visual functions. For this reason, diet recommendations are an essential part of an optometrists work and must be addressed as part of the primary care examination and during the vision training process.

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