As scientific and technological developments continue to be made, many people argue that the expanded power of scientists may cause them to “play G-d” as they manipulate natural processes. G-d commanded the Jews to fast on the holiest day of the year. Yom Kippur, which literally means Day of Atonement, is the day on which G-d forgives the individual for her past sins and seals her fate for the coming year. Those who repent will be forgiven, so the day is spent in prayer and is the most widely practiced fast day in Judaism. The commandment to fast on this day is noted in Scripture: “On the tenth day of this month it is the Day of Atonement; there shall be a holy convocation for you, and you shall afflict your souls” (Leviticus 23:27). The underlying principle of afflicting the soul is that avoiding physical pleasures - including eating and drinking - will help the individual focus instead on her spiritual state and reach inner purification [1]. A common side effect of this 25-hour fast is development of a headache which has been shown to occur in 40% of Jews observing the fast. Although the exact physiological basis for this type of headache is unknown, possible causes and treatments have been studied and tested. Many Rabbis have agreed that studying the physiological effects of 25-hour fasts with the intention of testing and developing methods for relieving excessive discomfort does not interfere with the Divine commandment to “afflict your souls” [2]. Instead it will enable fasters to better concentrate on repenting and encourage more people to undertake the fast.

Developing effective methods for preventing this type of headache - commonly called the Yom Kippur headache - must follow an understanding of the physiological basis for the headache. A fasting headache has been identified as a secondary headache, one which is caused by an underlying condition, and is attributed to a disorder of homeostasis. The patient must have fasted for more than 16 hours, develop it during fasting, and it must be resolved within 72 hours after food consumption. It must also have at least one of the following characteristics: frontal location, diffuse pain, nonpulsating quality, and mild or moderate intensity. The Yom Kippur headache was first identified as a fasting headache in the 1994 study by Mosek et al. who studied the prevalence of headache on 211 subjects who observed the Yom Kippur fast. The headaches of the subjects were characterized by the same features that characterize fasting headaches. Mosek et al. also found that subjects with a history of headache are more likely to develop the Yom Kippur headache and that the frequency of headache attacks increases with the duration of the fast [3].

Therefore, to maximize the amount of glycogen stored in the muscles, many recommend loading up on carbohydrates a few days before Yom Kippur. This is similar to what runners do before a marathon.

Later studies by the same and other scientists have helped elucidate the basis for the Yom Kippur headache, although much remains to be understood. In 1999 Mosek et al. investigated dehydration as a possible cause for the Yom Kippur headache. Because weight loss during the fast is mainly a result of dehydration, they were able to compare the average weight loss of their subjects and the prevalence of headache. However, the findings found no correlation between weight loss and headache and therefore ruled out dehydration as a cause for the Yom Kippur headache [4]. Interestingly, also in 1999 Awada et al. studied headache during the first day of Ramadan. The clinical features of the first-of-Ramadan headache (FRH) were found to be similar to those of the Yom Kippur headache. The observation that the frequency of headache increased with the duration of the fast and that those with a past history of headache were more likely to develop fasting headache confirmed the findings of Mosek et al. However, some of their findings differed significantly. Awada et al. found that water intake led to the disappearance of headache in some of their subjects, which showed a correlation between dehydration and headache. They also found that tea or coffee consumption resolved the headache in over half of the subjects, whereas Mosek et al. had found no correlation between coffee/tea consumption and headache [3].
Based on these findings, possible mechanisms and treatments for the Yom Kippur headache have been proposed. A common cause for migraine-like symptoms - including headache - is caffeine withdrawal. Fasting has therefore been identified as a possible cause for the caffeine-withdrawal headache. This correlation was demonstrated by Nikolajsen, who found that patients who consumed more than 400 mg/day of caffeine were more likely to develop headache during preoperative fasting [3]. While these findings support those of Awada et al., they are not supported by the findings of Mosek et al., who found no correlation between coffee/tea consumption and the prevalence of the Yom Kippur headache. Despite this discrepancy, many people suggest cutting down on the amount of caffeinated beverages consumed the week before the fast [5].

Another attempt to relieve the discomfort of the Yom Kippur headache employed an anti-inflammatory pain-relief drug. Rofecoxib (also known as Vioxx®) inhibits Cox-2, an enzyme that causes pain and inflammation, and it has a long plasma half-life, allowing for continued drug activity. In a 2004 study, Drescher et al. investigated the effects of Rofecoxib on the Yom Kippur headache and found that only 18.9% of subjects who received the drug reported a headache at some point during the fast, while 65.4% of the subjects who received the placebo reported a headache [2]. However, also in 2004 Vioxx was taken off the market because its long-term, high-dosage use was reported to cause an increased risk of heart attack and stroke [6]. Drescher conducted a similar study on the 2008 Yom Kippur. This time he used etoricoxib, which also has a long plasma half-life and has pharmacological properties similar to rofecoxib. Again, he found a decreased rate of headache in the group that received the drug and concluded that the drug effectively decreases the likelihood of developing the Yom Kippur headache [7].

While studying the causes and treatments for the Yom Kippur headache helps relieve excessive discomfort, another approach to relieving unnecessary pain comes from studying the dietary composition of the pre-fast meal and its effects on fasters. Blondheim et al. investigated this correlation in a study where different pre-fast meals were given to the test subjects. While the meals were equicaloric and contained equal amounts of sodium and water, they differed in their main source of calories - fats, carbohydrates, or protein. Each subject was tested with each of the pre-fast meals. They were evaluated by their degree of hunger and thirst throughout the fast, as well as their subjective discomfort during each experimental fast as compared to the discomfort usually experienced during religious fasts. The subjects reported significantly higher levels of discomfort after the protein-rich pre-fast meal than after the carbohydrate-rich and fat-rich meals. Additionally, there tended to be higher rates of thirst after the protein-rich meal. Based on their findings, Blondheim et al concluded that a protein-poor pre-fast meal is likely to bring easier fasting [8].

Some nutritionists also recommend eating increased amounts of carbohydrates for a few days before Yom Kippur [9]. On a normal day, the human body relies on the ingested carbohydrates to fuel its metabolic activities, especially brain metabolism [3]. However, on a fast day the body must rely on the glucose stored in the liver, in the form of glycogen, as its source for energy. While liver glycogen provides about three quarters of the necessary glucose, the remainder is from the additional glycogen stored in the muscles. Therefore, to maximize the amount of glycogen stored in the muscles, many recommend loading up on carbohydrates a few days before Yom Kippur. This is similar to what runners do before a marathon [9].

Interestingly, glucose levels might also be related to the Yom Kippur headache. In addition to caffeine withdrawal, another proposed mechanism for the Yom Kippur headache is hypoglycemia. Reduced blood glucose levels are generally thought to trigger or worsen migraine attacks. However, other scientific evidence does not support this hypothesis. For example, studies have shown that insulin-induced hypoglycemia does not cause headache attacks in migraineurs. The exact physiological cause for the Yom Kippur headache is unclear. Scientists suggest that the psychological strain of fasting and change in daily habits might cause a headache attack, especially in predisposed individuals [3]. One can imagine that the stress of Yom Kippur, when man stands in judgment before G-d, would especially contribute to this psychological strain.

Scientific investigation and experimentation have led to a deeper understanding of the Yom Kippur headache and of the dietary regulations that could help alleviate excessive discomfort on Yom Kippur. Although the underlying cause for the Yom Kippur headache is still unclear, the study conducted by Drescher et al. in 2008 demonstrated that etoricoxib decreased the prevalence of Yom Kippur headache. They received approval from Rabbis to conduct the study because the drug treatment does not interfere with the commandment “to afflict your souls.” While the drug might alleviate headache pain, it does not remove all effects of hunger and the faster will still experience the affliction that is described in Scripture [6]. While there seems to be no halakhic issue with developing such treatments, some individuals have expressed
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