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The effectiveness and health impact of fad diets on obese patients: a literature review

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Abstract

Introduction and purpose

Obesity is a serious health problem nowadays and it is becoming more and more common. There are plenty of causes of obesity including bad eating habits, genetic factors, and psychological factors. A lot of obese people look for a way to lose weight. Fad diets are popular dietary strategies which are promoted as a quick way to lose weight. This article highlights some popular dietary strategies including low-carbohydrate diet, low-fat diet,

Paleolithic Diet and Detox Diet. The aim of this paper is to analyse their effectiveness in the process of successful weight loss and their health impact.

State of knowledge

According to WHO in 2022 1 in 8 people in the world were obese. Fad diets are promoted as methods to improve health and as a quick way to lose weight. However, available research suggests a rather unfavorable impact on human health in the context of long-term adherence to these diets. Limited data suggests the beneficial long-term health impact of such diets. Moreover, dieting and weight cycling caused by the repetitive process of weight loss after dieting and weight regain afterwards may also play a role in the development of obesity.

Conclusion

Fad diets are not recommended as a long-term way of nutrition. The main limitation of these dietary strategies is their short-term effectiveness rather than long-term. Adherence to these diets is hard for patients. Because of their strict rules and food exclusions, the risk of weight regain is high. Moreover, they do not show many positive long-term health consequences and they are not superior to conventional healthy diets. What's more, strict obedience to fad diets for extended periods of time may be detrimental to the dieter's health.

Keywords: fad diets, health, low-carb diet, low-fat diet, Paleo diet, detox diet

Introduction and objective

Obesity is a serious health problem nowadays. Year by year it is becoming more widespread to an extent in which it has become classified as a civilizational disease. It is defined as a chronic disease connected with excessive fat deposits that can impair health. We say that one is identified with obesity when their BMI (Body Mass Index) exceeds or is equal to 30. BMI is counted by dividing a person's weight in kilograms by the square of the person's height in meters.

According to WHO in 2022 1 in 8 people in the world were obese. The number of obese patients has doubled since 1990, and it has quadrupled among adolescents [1].

Obesity increases the risk of many diseases such as type 2 diabetes, heart diseases, and certain cancers. It can also affect bone health, reproduction and quality of sleep as well as cause

problems with daily activities. Moreover, the life expectancy of obese patients is reduced by 6 to 7 years [2].

Many patients suffering from obesity dream about losing weight. This may be the reason why people start dieting. By following trends or by being subjected to biased media they might choose popular dietary strategies, also known as “fad diets”. A fad diet is a popular dietary pattern which is promoted as a quick way to lose weight [3]. Those popular dietary strategies have some more characteristics: they focus on short-term effects rather than long-term, use one type of food or exclude a certain group of food, they are difficult to maintain for a long time, they do not provide health warnings and scientific evidence to support their claims is missing [3]. In this article we will analyse the effectiveness and health impact of some of them.

The aim of the study

The aim of the study is to show the effectiveness of popular dietary strategies and their health impact. Moreover, the study pays attention to the role of dieting in the development of obesity.

Material and methods

The literature cited in this article were published in PubMed scientific database. They were found by searching the following words: “weight regain”, “obesity”, “weight loss”, “ fad diets”, “low-carb diet”, “ketogenic diet”, “low-fat diet”, “paleolithic diet”, “detoxification”, “detox diets”.

State of knowledge

The role of dieting in development of obesity

The fact that losing weight by dietary intervention is beneficial to health is well-known. Less people are aware of the potential adverse effects of dieting and weight cycling. Weight cycling is a term used to describe the repetitive process of weight loss after dieting and weight regain afterwards. “Being on diet” is not only the issue of obese patients. A lot of normal-weight people (or even underweight) choose to diet in this way as they view it as something effective. Dieting shows a correlation with increased risk of eating disorders or other psychological disorders such as anxiety and depression. Moreover, there is a bigger probability of type 2 diabetes, hypertension, cancer, diminished bone density and risks of bone fracture, inflammation and even increased mortality when following fad diets [4].

“Weight cyclers” are also associated with higher risk of metabolic and cardiovascular diseases [5].

The alarming fact is that dieting among normal-weight children, adolescents and younger adults is considered as a strong predictor of future weight gain [6]. One hypothesis says that dieting itself is not a cause of obesity development, but the kind of people who like to practice it might have a bigger predisposition to gain weight. They start diets when they notice the weight gain [7]. On the other hand, the studies on twins show that dieting may be the cause of future weight gain despite the genetic, familial or environmental predisposition [8].

Next reason for weight gain after dieting may be explained by the fact that during weight loss a person loses fat and fat-free mass (FFM). The study shows that when lean patients lose weight, they lose more FFM. Moreover, the feedback signals from reduction of fat mass and FFM take part in weight regaining through effects on energy intake and adaptive thermogenesis. Fat shows a faster rate of recovery than FFM - it is a way of autoregulation in lean people [9]. Hyperphagia is the effect of temporal disproportion of fat and FFM until their complete recovery. Furthermore, the complete FFM recovery is connected with excess fat. It can explain the “fat overshooting” after dieting which becomes dangerous when a person repeats the cycles of weight losing and gaining and can lead to development of obesity. Of course, this pattern of faster fat recovery than FFM is true when the patients follow an unbalanced and unhealthy diet for an extended period of time [9].

The next aspect is the role of adipose tissue in weight regain. Dieting triggers the reduction of adipocyte size, which in turn changes their metabolic traits. It causes them to clear and prepares them to store the ingested energy as a way to restore body fat in the future. This modification takes part in excursions of circulating nutrients such as glucose and fatty acids after weight loss. This mechanism explains that the energy gap between increased appetite and lower energy expense, which is created during weight loss, would be present during weight regain (as tissue clears and stores excess energy). During weight regain the adipocytes enlarge their size and they gradually lose the ability to clean excess energy [10].

The next important aspect of weight gain is the role of gut hormones. Gut hormones play a crucial role in regulating energy balance by influencing both the biological need for food (homoeostatic) and the pleasure-driven aspects of eating behavior (hedonic) through interactions with brain circuits. Mechanisms which stop the process of weight loss and defend the higher body weight are activated when energy restriction starts. Modified gut hormones are crucial for those mechanisms and take part in weight regaining after dietary weight loss [11]. One study showed the role of gut hormones in weight regain [12]. According to this

research, at the end of the weight loss process, the levels of circulating anorectic hormones like Peptide YY3-36, cholecystokinin, amylin and insulin, leptin were diminished. On the contrary, the level of orexigenic hormones like ghrelin and levels of glucose-dependent insulinotropic polypeptide and pancreatic polypeptide increased. Moreover, the weight of the participants returned to the primary value, and the changes occurred in gut hormones remained. The modifications in the level of gut hormones are connected with reduced satiety, causing the patients to eat more after dieting. The composition of diet used to reduce weight also plays a role in the variation of gut hormones [11]. Furthermore, the studies which used functional brain MRI (fMRI) showed that obese and overweight patients, who underwent a calorie-restricted diet (which ended up with weight loss) show increased brain activation in areas that are connected with reward and it is correlated with increased level of ghrelin and reduced level of leptin. It happens when they see food cues [13]. Moreover, the amount of weight loss interventions during life is correlated with the degree of reactivity when the patients saw food [14]. This result may be used to predict the probability of weight regain.

Other causes of obesity

The main cause of obesity is known as an energy imbalance between consumed and expended calories [15]. Research shows that unhealthy habits, such as excess drinking, smoking, insufficient exercise, and overeating may lead to development of obesity and other chronic illnesses [16]. Energy-dense food, which is highly rewarding and available, has a crucial role in maintaining bad eating habits which leads to development of obesity. High-fat, high-sugar junk food can be addictive because they stimulate brain reward centres which makes it hard to stop eating such unhealthy foods [17].

Despite that, there are plenty of other causes of obesity. One of them is the presence of this condition in the family. When one parent is obese, there is a three-time risk for a child to become obese as an adult. When both parents are obese, the risk of it increases 10 times [18].

Some psychological factors also play a role in obesity occurrence. One study showed that the middle-aged, people suffering from depression and stress, people who feel low satisfaction in life and the ones who bring in low annual household incomes are more likely to be obese [19]. Moreover, eating disorders, especially binge eating disorders and night eating syndrome, also predispose to development of obesity [2]. One of the issues explaining the fact why people gain weight after they lose it is the food obsession and the desire to eat “everything that was forbidden” during the diet. The periods of dietary restrictions are often followed by

uncontrolled eating [6]. Binge eating is one of the psychological problems affecting obese patients. People, who use energy restricted diets, are more prone to cravings for food and react to food cues [20]. This effect is stronger in obese patients which can be the reason why dieting is a bigger problem for them [11]. Moreover, there is a biological vulnerability for weight gain in obese people, especially the ones who prefer high fat foods and show strong hedonic attraction to palatable foods [20]. Furthermore, people's reward system can help them ignore the feeling of satiety that makes them eat even when they are not hungry and it makes overeating hard to control [11]. What is more, research using fMRI and food cue reactivity paradigms show neurobiological vulnerabilities in patients with obesity, which is another proof that they are endangered by increased risk of overconsumption [21].

Popular diets: ketogenic diet/low-carbohydrate

Low-carbohydrate diet assumes the restriction of carbohydrate intake: a person should eat less than 120 g of carbohydrates or less than 26% of diet energy. One of the types of low-carbohydrate strategy is ketogenic diet which was designed by Dr. Russel Wilder and it was created for epilepsy treatment. The standard keto diet is a rigorous plan that follows a 4:1 ratio, meaning four parts fat to one part carbs and proteins together. It is a very-low-calorie-diet which should be composed of 5–10% calories coming from carbs, 20–25% from proteins, and 65–80% from fats [22]. Carbohydrate deprivation caused by the ketogenic diet (KD) leads to a metabolic shift towards gluconeogenesis and ketogenesis. Initially, the body compensates for the lack of carbohydrates by producing glucose internally through gluconeogenesis. To meet the body's energy demands, ketone bodies are then produced as an alternative energy source via ketogenesis. During this stage, the reduced blood glucose levels result in lower insulin secretion, which decreases the drive for fat and glucose storage [3].

Effectiveness and health impact of ketogenic (KD)/low-carbohydrate diet (LCD)

The primary advantage of these diets is that they lead to reduced blood glucose and insulin levels and suppress appetite. This feature facilitates weight loss and reduction in body fat, contributing to improved management of type 2 diabetes, heart disease, and hypertension [23]. Ketogenic diets can prevent the weight-loss-related increase in ghrelin and reduce hunger while maintaining ketosis [24]. However, elevated levels of ghrelin and hunger returns when a patient comes back to a regular, non-fad diet [25]. In a short-time perspective, ketogenic diet is effective for weight loss. Due to their significant impact on metabolic processes, these diets

should be confined to the early stages of a weight loss plan, for a duration of 6–12 months, and should not be adopted as permanent dietary habits [26].

Research consistently supports the conclusion that the ketogenic diet (KD) is an effective intervention for enhancing the quality of life, reducing seizure severity, and decreasing seizure frequency in patients with epilepsy [27]. Moreover, it shows neuroprotective properties in some neurological conditions such as Alzheimier's disease, amyotrophic lateral sclerosis, Parkinson's disease, ischemic brain injury, traumatic brain injury, depression, autism, and narcolepsy [28]. It's common for individuals using the ketogenic diet to experience short-term, minor side effects like vomiting, nausea, digestive discomfort, fatigue, dizziness, faintness, decreased energy, and changes in heart rate because of ketosis [29]. Maintaining the LCD over the long term (typically lasting at least three months) can lead to deficiencies in minerals, vitamins, and trace elements in the diet, which may result in complications concerning bone health, kidney stones, and, on occasion, growth impairment [30]. Another complication of KD is hypercalcemia [3]. Additionally, decreased levels of alkaline phosphate (ALP) were observed in all participants of one study except for the two eldest, with seven individuals displaying compromised kidney function [31].

KD also impacts lipid profile and it tends to be negative. One study compared the influence of low-fat diet and low-carbohydrate diet on lipid profile [32].Clinically, lipid levels such as LDL, HDL, and TGs serve as prognostic indicators for cardiovascular disease (CVD). The level of triglycerides (TG) was reduced and the level of HDL increased. Moreover, participants following low-carbohydrate diets saw a more substantial increase in LDL cholesterol and total cholesterol (TC) overall, although the results were not statistically significant beyond 12 months, possibly due to insufficient sample size. Poor adherence to the recommended macronutrient composition in these diets may have led to reduced effectiveness after 12 months, as non-compliance tends to rise over time [33]. One case report also examined a potential influence of KD on lipid profile in overweight men [34]. It showed that KD caused severe hyperlipidemia in the participants: after 7 months of KD the level of LDL, HDL, TC and TG increased. Following a two-week increase in carbohydrate intake, there was a notable improvement in the lipid panel.

The biggest limitation of KD is inadequate compliance with dietary guidelines stands as a significant factor contributing to the limited effectiveness of dieting efforts [35]. Furthermore, the successful adoption of the LCD often involves significant restrictions on food choices, which can lead to insufficient nutritional intake. This presents an additional challenge to maintaining ongoing adherence to the LCD [36].

Popular diet: low-fat

Obesity has traditionally been attributed to the overconsumption of energy-dense foods, especially those rich in fat. Consequently, since the 1950s, physicians have recommended lowering fat intake as a strategy for weight loss [37]. The regular low-fat diet is composed of 20-25% energy coming from fats. There is also a very-low-fat variant which consists of 10-20% energy coming from fats [38].

Effectiveness and health impact of low-fat diet

This diet shows a short-term efficacy in weight loss due to calorie shortage, however the long-term effectiveness of this dietary strategy is disappointing [39]. Evidently, achieving a strict low or very-low fat intake is challenging, particularly in long-term studies, as actual fat consumption often surpasses the recommended levels. Research suggests that over the long term, low-fat diets (LFDs) and low-carbohydrate diets achieve comparable results in weight loss. Moreover, it does not demonstrate any significant differences in body fat reduction compared to other diets [40].

One study shows that low-fat diets, whether accompanied by physical activity or other interventions, decrease both overall mortality and non-fatal heart attacks in individuals at heightened risk of cardiovascular issues [41]. Moreover, it can reduce the level of neprilysin - it is a zinc metallopeptidase enzyme which breaks down various bioactive peptides, including natriuretic peptides, thereby ending their biological effects on arterial blood pressure and natriuresis. Obesity leads to increased levels of neprilysin which takes part in increased risk of heart failure. A low-calorie low-fat diet is the intervention which may decrease the level of neprilysin in obese patients and contributes to the positive impact of weight loss on glucose regulation and heart function [42].

Obese patients have an increased risk of metabolic-dysfunction-associated fatty liver disease (MAFLD). One research states that well balanced low-fat diets offer protection against MAFLD, whereas unbalanced ones can elevate the risk of MAFLD. These results indicate that preventing MAFLD could potentially be enhanced by monitoring both the amount and quality of dietary intake [43].

Furthermore, low-fat diets enhanced the dilation of the brachial artery and lowered the blood pressure [44].

When it comes to the influence of LFD on lipid profile, the research says that lowering of fat

intake from about 40% to about 20% of total calories was shown to decrease cholesterol by about 15% [45]. Decreasing fat intake often involves an increase in carbohydrates, which can lead to carbohydrate-induced hypertriglyceridemia. This should be viewed as an adverse outcome of adopting a low-fat diet [46]. Including adequate fiber in diets containing up to 70% carbohydrates prevents hypertriglyceridemia, although it may cause a reduction in HDL cholesterol levels [47].

Low-fat diet seems to offer a few health benefits and show short-term effectiveness, but due to poor adherence to its assumptions it may not be long-term effective. Moreover, it does not show superiority over more conventional diets.

Popular diets: Paleo Diet

Paleo Diet (PD) was first introduced by Eaton and Konner in 1985 and later published by Dr. Loren Cordain in 2010 [48]. The assumption of this diet is that Paleolithic foods are better aligned with our genetic makeup compared to the modern diet. It happens because humans evolved prior to the advent of agriculture, but our diet has changed more quickly than our genetics [48]. The human genome has not adapted to the drastic lifestyle changes brought about by modern civilization [49]. The Paleo diet consists of fresh vegetables, fruits, lean meats, poultry, fish, eggs, tofu, nuts, and seeds, while excluding cereals, grains, legumes, and dairy products [50]. The Paleo diet is characterized by a low ratio of n-6 to n-3 fatty acids and a high content of phytochemicals that may offer health benefits. It is high in protein (25–35% of energy) and moderate in fat and carbohydrates, with an emphasis on low glycemic carbohydrates [51].

Effectiveness and health impact of Paleo Diet

Studies show that the Paleo Diet is effective in short-term as well as long-term body weight reduction even when it is unintentional [52, 53]. There was one research which tracked the subjects for more than two years [52]. During this randomized trial, 70 post-menopausal obese women were divided into two groups: one followed PD, and the second one Nordic Nutrition Recommendations diet. After 24 months, both groups showed reductions in waist circumference, fat mass, and weight, regardless of the diet they followed [54]. The advantage of this diet is its composition. It has been suggested that a high protein content in the diet may boost satiety and aid in weight loss [55]. Still, this dietary strategy is not more effective than conventional diets for weight loss.

Potential side effects of PD are weakness, diarrhea, and headaches. Another aspect to consider with the Paleo diet is that due to its exclusion of dairy products, it often lacks calcium, which could lead to reduced bone density and greater risk of fractures [52]. A lack of adequate calcium in the diet is a concern because it may increase the risk of calcium oxalate stone formation, potentially due to heightened hyper-oxaluria [56]. The Paleo diet is promoted to bring benefits such as improved insulin resistance and resistance to type 2 diabetes or reduction in cardiovascular disease risk factors [55,57]. At the same time, there are contrary studies which suggest that PD does not impact significantly on HOMA-IR index. Elevated fasting insulin levels are associated with increased tissue resistance to insulin, as indicated by the HOMA-IR index [58]. What is more, PD does not impact significantly fasting blood glucose in comparison to other diets [58]. Furthermore, long-term adherence to the Paleolithic diet might not benefit gut health, as it is associated with reduced relative abundances of beneficial bacterial genera and increased relative abundance of the TMA-producing genus Hungatella. TMAO has been linked to cardiovascular disease (CVD) and atherosclerotic plaque formation in both animal and human studies [59]. Moreover, one research suggested that adherence to the Paleo Diet was linked to a reduced risk of proximal colon cancer, but not distal colorectal cancer (CRC). Although, the results require further validation in different populations and contexts [60]. Another study demonstrated that The Paleo Diet (PD), either independently or when paired with lifestyle factors, showed a notable decrease in NAFLD risk within the entire population [57]. The influence of the Paleo Diet on lipid profile is not clear, due to diverse studies results. One investigation showed the increase of HDL cholesterol in diabetics in contrast to the healthy population [61,62]. A two-year intervention revealed no significant changes in total or HDL cholesterol levels, despite notable reductions in triglycerides during the intervention period [54]. On the contrary, another study showed that there were small but significantly higher HDL concentrations in the participants who used PD, linked to reduced carbohydrate intake and increased saturated fat consumption [59]. The existing data on the relationship between saturated fat and HDL concentrations should be approached cautiously, as saturated fat intake was also correlated with total cholesterol concentrations in the Paleolithic groups and could potentially elevate the risk of cardiovascular disease (CVD) over a longer period [59]. Another study states that this dietary strategy results in decreased levels of TC [63].

The Paleo Diet is an effective method in weight loss, but it does not show superiority over more conventional methods. The problems with this diet may refer to poor adherence and the high cost of the diet. Moreover, it can be hard for the people who try this method to exclude

particular products. The advantage of this diet is resignation from processed-food. But we need to keep in mind all of the negative health aspects that this diet might cause, such as hypocalcemia or unfavorable influence on gut microbiota.

Popular diets: detox diets

Another popular dietary strategy is a detoxification diet. It is often connected with low calories intake. It provides <500 - 800 kcal/day (whereas an average adult should consume around 2000 kcal/day). The main assumption of a detoxification diet is toxin elimination, improving health and weight loss. Usually it lasts a few days or weeks and it is composed of specific products like juices, soups, some vegetables, fruits, supplements which replace all meals [50]. The availability of specific products depends on a particular strategy. Many of them require using laxatives and supplements. The most popular strategies are liver cleansing diet, lemon detox diet/Master cleanser, The clean cleanse, Martha's vineyard detox diet, Weekend wonder detox, Fat flush, Blue print cleanse, The Hubbard purification rundown [3]. Despite their growing popularity, these diets do not clarify the mechanisms by which they eliminate toxins or specify which toxins are removed by each diet. Moreover, detox methods contradict basic human physiology principles since the liver and kidneys are highly effective at eliminating toxins.

Effectiveness and health impact of detox diets

Unfortunately, the literature review on the effectiveness and potential risks of detoxification diets is quite limited and the studies which are available have methodological weaknesses like small sample sizes or absence of control groups [3]. These diets may be effective in a short-term time due to severe calorie reduction, loss of water and fecal weight because of the laxatives use [50]. However, there is no clinical evidence to support or refute the effectiveness of commercially available detox regimens for weight loss. These diets provide extremely low calorie intake which can lead to increase in stress hormones levels such as cortisol. This can have a bad influence on a person who uses this diet because of appetite stimulation which can result in weight regain due to binge eating [64]. Many detox diets are liquid-based, low in calories, and deficient in nutrients which can lead to macro and micronutrients deficiencies or even malnutrition. Other side effects may maintain laxative abuse and severe hyponatremia [50]. One case report describes a A 51-year-old woman with no prior health issues reported to the ED with a one-week history of malaise, muscle pain, unsteadiness, and mild intermittent headaches. Physical examination found neurological signs, such as a broad-based gait and

low-amplitude tremors on both sides. Laboratory testing indicated acute severe hyponatremia, with an electrolyte level of 115 mmol/L. The only change which the patient reported was that she began consuming an over-the-counter “detox tea” four weeks earlier, drinking about two cups daily [65]. These teas are recommended in some detox diets and this case may be alarming in this context. Moreover, one of the detox diets based on juices, particularly when followed by the heavy consumption of oxalate-rich juices, seems to be a potential cause of oxalate nephropathy and acute renal failure [66].

Detoxification is an extreme method of weight loss. It may be effective due to very low calorie intake, although it is not sustainable in the long-term. This method is connected with health risk because of nutritional deficiency. Moreover, the risk of binge eating and weight regain is high.

Conclusion

Dieting is a very popular way to lose weight not only among obese patients. People nowadays are bombarded by new diet ideas for losing weight on a daily basis. The main problem with using fad diets instead of a more conventional, healthy way of eating, is that they show short-term effectiveness rather than focusing on long-term benefits. It is hard for patients to adhere to these popular dietary strategies because of the exclusion of some products which they probably like, very low calorie intake or high costs of those diets. Moreover, the periods of dietary restrictions are often followed by uncontrolled eating. People who use energy restricted diets are more prone to cravings for food and react to food cues. Furthermore, dieting and restrictions can deprive the reward system of dieters. The next problem with fad diets is that they are not more effective than conventional, healthy diets and they do not show that many health benefits. More often than not, it would be healthier for people to not diet at all instead of being on a fad diet for an extended period of time. There are not many studies which investigate long-term effects and health results of these diets. More research should be done to investigate the health consequences of using fad diets. What is more, dieting and weight cycling may be the reason for obesity development in some patients. Weight regain risk is high which can lead to lack of motivation and faith in success. It can also lower the self-esteem of the patient. Lifestyle changes and healthy eating are necessary to cure obesity, although there are better ways to achieve this goal than using fad diets. Healthy, well-balanced diet and physical activity should be the primary change. Diet which is well tailored to the needs of obese patients and is composed of the products which a person enjoys is the most effective approach. The important fact is that some obese patients need to take

medications to effectively lose weight. In some cases bariatric surgery is the main and the most efficient method of weight loss.

Disclosure

Author's Contribution Statement

Conceptualization, Adrianna Kraszkiewicz and Dominika Zaliwska; methodology, Anna Dąbrowska; software, Marta Justyna Gonciarz; check, Dominika Karolina Adamiec and Monika Anna Kamińska; formal analysis, Marta Justyna Gonciarz, Natalia Paduszyńska; investigation, Monika Kienanh Do; resources, Agnieszka Aleksandra Strojny and Dominika Karolina Adamiec; data curation, Adrianna Kraszkiewicz and Magdalena Czach; writing - rough preparation, Adrianna Kraszkiewicz, Monika Kienanh Do, Monika Anna Kamińska; writing - review and editing, Magdalena Czach and Agnieszka Aleksandra Strojny; visualization, Anna Dąbrowska; supervision, Dominika Zaliwska; project administration, Natalia Paduszyńska

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