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Perceived impact of food additives on leptin control among Iraqi population

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Abstract
Food additives, one of the primary methods of preservation, are used to improve shelf-life and prevent spoilage through the inhibition of bacteria. Some of the additives are shown to have potential negative effects on humans, by disrupting metabolism and its regulating hormones (one example is leptin, which regulates energy balance and limiting food intake) .
This study was designed to look at the suspected association between food additives and its effect on the leptin level in a group of Iraqi subjects. A structured questionnaire was used and data were collected from 750 Iraqi volunteers aged 18 years and older from different regions in Iraq.
This questionnaire gathered data about dietary habits evaluation, food additives awareness and perceptions regarding hormonal swings. Results showed 525 of participants (70%) agreed that those supplements can affect hormone levels. Moreover, sodium benzoate was the most perceived affecter followed by potassium-based chemicals. In addition, there was a slight variation regarding restaurant and home food consumption patterns. In general, the findings obtained are based on perception rather than direct biochemical measurement, accordingly no connection can be established. This study highlights the gap between public awareness and scientific evidence and emphasize the need for further clinical research.

Keywords: Leptin Regulation, Food Additives, Metabolic Health, Public Perception, Hormonal Imbalance

Introduction

Chemical food preservatives added to dietary products for spoilage prevention, expiry extension, and high-quality maintenance. They play a key role in food industry by inhibiting the growth of microbes that can lead to food related illnesses and spoilage.

Preservatives have different mechanisms through which they inhibit microbial growth and enzymatic processes that can lead to food deterioration. Take sodium nitrite as an example, it functions by creating an anaerobic environment that inhibits the growth of bacteria. Some, like citric acid, works by lowering the pH of food, making the microbial growth less likely.

Leptin is a key hormone in regulating appetite and balancing energy in the body. Fat cells release it and it informs the brain about total body fat storage, which influences hunger and metabolism. While research on sodium benzoate's effects on leptin levels is limited, some studies suggest that excessive exposure to food preservatives may disrupt hormonal balance, including leptin. The relationship between sodium benzoate and leptin is not fully understood, but there is potential for sodium benzoate to affect metabolic processes indirectly through inflammation or liver function changes [1].

Previous studies have suggested that exposure to high levels of nitrates may lead to metabolic disturbances that can indirectly affect leptin signaling and function. Nitrate exposure may influence the balance of nitric oxide in the body, which has been associated with metabolic regulation, including leptin secretion [2].

Certain animal-related research suggested that saccharin may interfere with normal leptin regulation, possibly resulting in intensified appetite and weight gain, even with low calorie consumption. However, the effects may be of personal variation based on individual responses and the general sweeteners consumption [3].

Researchers in the disciplines of nutrition and health are currently more interested in the potential impacts of food preservatives on leptin hormone. Leptin, a protein hormone that primarily released by adipose tissue, plays a very important role in appetite, metabolism, and weight control. When the total body fat levels go up, leptin production increases too. This sends certain signals to the brain that the body has sufficient fat storage and eventually reducing food intake. Any change to this system can cause problems like obesity and metabolic disorders [4].

Preservatives, specifically of chemical nature such as benzoates, parabens, and nitrates, might have unanticipated impacts on overall health. There are hypotheses suggesting that preservatives may indirectly influence leptin through several mechanisms and researchers are still working for the clear mechanism of effect [5].

Methodology

1. Study Design

This research was structured as a cross-sectional observational study for the investigation of the possible effects of dietary additives on the levels of leptin hormone among the Iraqi population. The study sought to assess the correlation between food additive intake habits and volunteers perceived alterations in leptin levels.

2. Study Population & Sample Size

This study had a total of 750 participants. The selection utilized convenience sampling. From multiple regions across Iraq, the volunteers were engaged in either an online or in-person survey.

2.1 Inclusion Criteria

- Adults aged 18 years and older.
- Individuals who regularly consume processed foods containing food additives.

- Willingness to participate and provide informed consent.

2.2 Exclusion Criteria

- Individuals with altered leptin levels due metabolic disorders (such as diabetes, obesity, and endocrine disorders).
- Individuals on medications known to alter metabolism of leptin.

3. Data Collection

The questionnaires were divided into four parts and were used to collect data.

3.1 Food Consumption Patterns

- The survey asked whether respondents consumed food at home or in restaurants.
- This was analyzed to see if restaurant food which may have greater ingredients had higher effect on leptin hormones.
- 400 were served restaurant food, whereas 350 consumed the same food prepared in a home kitchen with slight variations

3.2 Awareness and Perception of Food Additives

The participants were asked whether food additives changed their leptin levels. (Yes/No responses).
Results: 525 cases replied "Yes" and 26 give "No" answers to the proposal food additives. 225 disagreed ("No").

3.3 Type of Food Additives Analyzed

- Participants recognized additives they encountered, which included:
- Sodium Benzoate (726 responses, highest reported exposure).
- Potassium (668 responses).
- EDTA (E-numbers related to preservatives) (461 responses).
- BHT/BHA (363 responses).
- PVA, Sugar, and Dyes had lower response rates (ranging between 82–242).

Results and Discussion

The Figure 1 cross-tabulation analysis of responses regarding the possible effects of Food additives on the hormone leptin demonstrates that 525 out of 750 volunteers (70%) agreed, while only 225 individuals provided a negative response, demonstrating a general consensus that food additives may change the regulation of leptin.
Answers like "no" reflect either that the situation was unclear or that the consequences were not taken into account. To find out what influence's participants' support or lack thereof for the possible outcomes, more research is required. For some additives, a distinct variability in the response distribution was noted.
The highest number of response count was recorded for sodium benzoate (726; 21.17%), closely followed by potassium-based additives (668; 19.48%), indicating a substantial correlation with leptin hormone concentration or their prevalent use in products frequently consumed. EDTA was the third in ranking (461; 13.44%), followed by BHT/BHA (363; 10.58%), suggesting potential effect for these additives of moderate impact. On the contrary, additives such as PVA (242; 7.06%), sugar (131; 3.82%), and food dyes (82; 2.39%) were at the bottom of the list exhibiting the lowest response rates, reflecting participants diminished awareness of their effects or their restricted usage. These results highlight the importance of future research on additives with higher reaction rates, such as sodium benzoate and potassium, to better enhance the comprehension of their impact while also considering the potential role of additives with fewer responses that may have less evident effects.
Most of the responses were affirmative (525 compared to 225), this indicates that many participants believed food additives impacts leptin hormone levels. This corresponds with most recent scientific evidence indicating that various food additives, including as preservatives and artificial sweeteners, may interfere with signaling of leptin and regulating metabolism. Prior studies corroborated such findings. Santos et al. (2020) discovered that sodium benzoate and other prevalent preservatives can provoke inflammatory pathways that diminish leptin sensitivity, leading to the ultimate result of dysregulated appetite control [6]. Moon et al. (2021) similarly found that exposure to sodium benzoate disrupts the activity of leptin receptor, diminishing the body response to the hormone and fostering leptin resistance [7]. Such pathways are often associated with high oxidative stress, since the metabolism of sodium benzoate can result in reactive oxygen species (ROS) overproduction, which lead to adverse impacts satiety signalling by hypothalamic regulation [8]. Moreover, inflammation of adipose tissue induced by additives such as sodium benzoate has been associated with impaired signalling and leptin resistance, promoting increased food intake and weight gain [6].
Despite the growing evidence, a portion of population either remains doubtful about these effects or lacks awareness indicated by the comparatively lower percentage of "No" responses. Stein et al. (2019), who highlight that despite the increased apprehensions regarding food additives, public awareness remains uneven due to insufficient educational initiatives and contradictory research funded by industry [6].
Notably, additives such as sugar and artificial dyes were receiving the lowest percentages of response, despite substantial scientific evidence correlating such products to metabolic problems. Lustig et al. (2017) have shown in their research that excessive fructose consumption induces leptin resistance, resulting in the misinterpretation hunger cues by the brain. This results in elevated calorie intake, insulin resistance, and weight gain [9]. This highlights a fact that the public awareness of the impact of these additives on leptin levels remains limited.

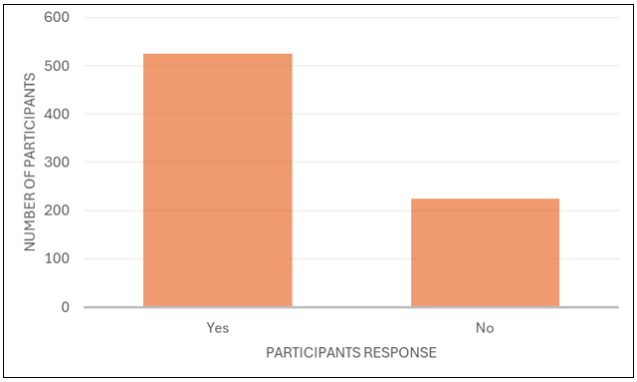

Fig 1: Iraqi population's perceptions on how food additives affect leptin levels (n = 750). Few people responded "no" (n=225),

showing a high perceived relationship, whereas the majority (n=525) voted "yes."

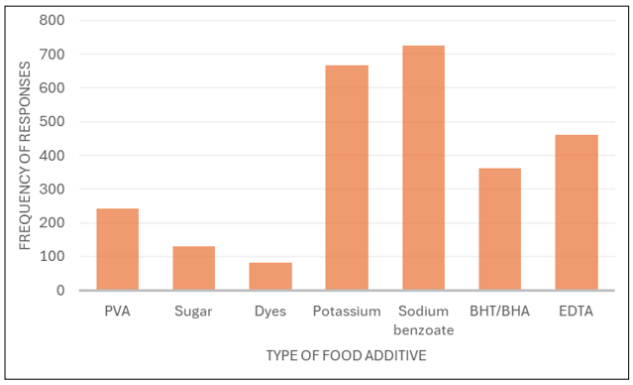

Fig 2: The responses given by participants about particular food additives thought to have an impact on leptin hormone levels were distributed.

Conclusion

The current study explored public perception regarding the potential impact of food additives on leptin regulation. A considerable proportion of participants believed that certain additives such as sodium benzoate, potassium-based preservatives and BHT/BHA may influence the balance of hormones and satiety responses.

These results are not supported by actual biological data, but rather by subjective impression. It is recommended that future studies explain these effects, focusing on the long-term metabolic risks linked to chronic exposure.

Statement of Conflict of Interest: "None to declare."

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