The Scapegoat Effect on Food Aversions After Chemotherapy

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The effects of consuming a novel food (halva) versus a familiar food (cookies) before gastrointestinal (GI) toxic chemotherapy on patients' preference for familiar foods consumed after chemotherapy treatment were compared. The development of aversions to the novel and familiar foods was also assessed. Patients with a history of posttreatment nausea consumed either a novel or a familiar food before chemotherapy and were asked to keep a food record through the next breakfast and to rate their preference for these foods. Patients who consumed halva before treatment were significantly more likely to increase their ratings for foods consumed after chemotherapy than patients who consumed familiar cookies. Aversions to the novel food were significantly more frequent than aversions to the familiar food. These findings provide evidence that a novel but not a familiar food consumed before chemotherapy can act as a scapegoat to prevent items in the regular diet consumed after chemotherapy from decreasing in preference. Providing patients with a novel food before chemotherapy is a useful clinical intervention to reduce the likelihood of forming aversions to familiar foods consumed after chemotherapy. Cancer 66:1649–1653, 1990.

Learned food aversions (LFA) to specific foods may result when consumption of the food is followed by nausea or emesis.¹ Such aversions result in reduced consumption or complete avoidance of the food. Thus, LFA may be a contributing factor in the reduced food intake and increased dislikes for certain foods observed in some cancer patients receiving chemotherapy that has emetic side effects.² Controlled studies have shown that adult and pediatric chemotherapy patients can acquire an LFA to a novel ice cream flavor if consumption is followed by chemotherapy-induced nausea.³,⁴ An LFA to familiar dietary items consumed before chemotherapy can also form.¹ A longitudinal study observing adult chemotherapy patients for 6 months during the course of chemotherapy found that over 50% of patients developed an LFA to at least one of the foods in their regular diet consumed in the 48-hour period surrounding drug administration.⁵

One behavioral method used to block LFA has been to provide a "scapegoat" food before chemotherapy.⁶ When pediatric inpatients consumed a pack of a strongly flavored candy (Lifesavers, Nabisco Brands, East Hanover, NJ) after a regular meal before chemotherapy, they were twice as likely to consume a portion of the same meal at a later date as when they did not consume the candy.⁶ The effectiveness of such scapegoat foods is presumably due to the fact that aversions are more easily learned to novel than to familiar foods.⁶ Animal experiments have shown that the association between a novel food and nausea protects familiar foods from becoming conditioned stimuli when both novel and familiar foods are consumed close to a gastrointestinal (GI) toxic drug injection.⁷ However, there is no direct evidence in humans for this hypothesis. The study demonstrating the scapegoat effect of Lifesavers on regular meals failed to determine whether patients formed aversions to the Lifesavers after treatment or whether the candy was novel to these subjects.

The current study assesses the magnitude of aversions to the scapegoat food. It also compares the effects of consuming a novel or a familiar food before chemotherapy
with preference for regular diet items consumed after chemotherapy.

**Methods**

Twenty-five adult outpatients undergoing chemotherapy at Carle Clinic in Urbana, Illinois, participated in the study. There were three men and 22 women ranging in age from 24 to 68 years. Sixteen were diagnosed as having breast carcinoma, three with non-Hodgkin’s lymphoma, two with Hodgkin’s disease, one with glioma, one with adenocarcinoma metastatic to the lung, one with lung carcinoma, and one with carcinoma of Mullerian origin. All except one subject were receiving a combination of antineoplastic agents. The most commonly used drugs in both groups either alone or in combination with others were Adriamycin (doxorubicin; Adria Laboratories, Columbus, OH), Cytoxan (Bristol Myers/Mead Johnson, Evansville, IN), 5-fluorouracil, and methotrexate. All subjects were undergoing intravenous (IV) chemotherapy with schedules that varied from once a week to once every 6 weeks, but no subject had more than one treatment in a single week.

**Design**

Novel versus familiar food aversion conditioning: Subjects were assigned to either the novel or the familiar group. The novel group consumed a novel food at the conditioning trial (before a chemotherapy treatment). The familiar group consumed a familiar food at this time. The food consumed at conditioning was referred to as “exposed food.” One to 6 weeks later, the testing trial was administered minutes before chemotherapy. At this time, subjects were offered the exposed food and a comparison food to determine whether an aversion to the exposed food was present. For each subject, a preference ratio was calculated as the number of grams of exposed food consumed at testing divided by total grams of food consumed at testing and expressed as a percentage. This ratio indicated the magnitude of the aversion. An LFA was defined as a value of less than 50% on the preference ratio.

Scapegoat effect on dietary items: Subjects rated their preference for regular dietary items consumed after chemotherapy on the day of conditioning through the next breakfast. A nine-point hedonic rating scale ranging from “dislike extremely” (1) to “like extremely” (9) was used to rate food preferences for the regular foods consumed after chemotherapy. A reduction of one or more points on this scale was scored as an aversion to these foods. Changes in ratings were compared between the groups by calculating a hedonic change ratio for each subject. This ratio consisted of the difference between the number of items increasing and decreasing in ratings divided by the total number of items changing in ratings. Thus, a positive ratio indicated a scapegoat or protective effect, whereas a 0 or negative ratio indicated no effect.

**Screening Interview**

Patients with a history of postchemotherapy nausea who were judged to have at least a 1-year life expectancy were referred to the study by their medical oncologist. Patients were told that the investigation would focus on the effects of chemotherapy and its side effects on certain aspects of nutrition. They were also told that they would be asked to eat certain foods and to refrain from eating 4 hours before their scheduled chemotherapy treatments while in the study. These patients were interviewed by one of three experimenters while they waited for a regularly scheduled chemotherapy treatment. At this time, it was determined whether patients met the entry criteria, and informed consent was obtained.

Criteria for participation included the following: (1) reporting postchemotherapy nausea on a regular basis (determined by an affirmative response to the question, “Do you normally experience nausea or vomiting after chemotherapy?”); (2) absence of allergies or dislikes for any of the foods used in the study or any dietary restrictions; and (3) at least one prior chemotherapy treatment and four more scheduled in the future. During this interview, subjects also ranked four types of cookies (double chocolate, peanut butter, oatmeal raisin, and sugar) from most to least preferred and reported whether halva was novel (never consumed) or familiar to them. Patients were not shown the cookies or halva during this meeting. Patients were then randomly assigned to one of the groups, with the exception that a comparable number of males were assigned to each group.

**Conditioning Trials**

Conditioning trials took place 10 to 15 minutes before the beginning of a subsequent chemotherapy treatment. Current hunger was recorded at this time by means of a visual analogue scale. The “exposed food,” which was either four cookies of the same kind (Cookies, Etc., Champaign, IL) or four pieces of halva (Sahadi and Co., Moonachie, NJ), were offered to the subjects. Subjects were told to “eat as much as [they] wished” and to “let the experimenter know when [they] finished eating.” One-half of the novel group subjects consumed marble halva and the other half consumed regular halva. Each subject’s most preferred cookie was used as exposed food in the familiar group. At the end of the conditioning trial, subjects were given a “take-home questionnaire” that was developed for this study. This questionnaire consisted of a food record with a hedonic ratings scale to rate foods consumed and postchemotherapy nausea assessment forms. Patients were asked to record all foods and drinks they consumed through the following breakfast and rate how they liked or disliked each food at the time of consumption on the hedonic ratings scale. The questionnaire...
included questions to assess duration and onset of nausea and a visual analogue scale to assess intensity of nausea. Subjects mailed back the questionnaires after completion on the morning after chemotherapy.

**Testing Trials**

The testing trials took place 1 to 6 weeks later and 10 to 15 minutes before a subsequent chemotherapy treatment. Subjects were offered the exposed food and a comparison food with instructions and procedures similar to those at the conditioning trial. In the novel group, the comparison food was regular halva for subjects exposed to marble halva, and marble halva for subjects exposed to regular halva. In the familiar group, the comparison cookie was each subject’s second most preferred cookie. Three subjects underwent two testing trials; the third most preferred cookie was used as comparison food at the second testing. After eating, subjects were asked to rate those foods that appeared in the food record they completed after the conditioning trial. Subjects were not informed of where this list of foods originated.

**Results**

Comparisons between the novel and familiar groups showed that the groups were comparable in age, sex, number of prior chemotherapy treatments, time elapsed between conditioning and testing trials, and diagnosis as indicated in Table 1. There were no group differences in the number of subjects reporting postchemotherapy nausea (11 of 12 novel and 10 of 13 familiar), in nausea intensity (Mann-Whitney U test, U = 69), duration (Mann-Whitney U = 29.5), time of onset (U = 64.5), number of subjects who took antiemetics (7 novel subjects and 8 familiar), or reported hunger at the time of the testing trial (t[23] = 0.87).

**Scapegoat Effect**

Hedonic ratings were available for ten subjects in the novel group and 11 in the familiar group. Because each subject consumed a different number of foods and increased, decreased, or showed no change in preference for different numbers of foods, hedonic change ratios were used to determine whether the exposed food acted as a scapegoat. Significantly more subjects in the familiar group decreased their preference for regular foods (defined by a negative hedonic change ratio) compared with subjects in the novel group, who increased their preference for dietary foods consumed after chemotherapy (Table 2; Fisher’s exact probability test, P = 0.02). Of the seven novel group subjects with an LFA to the exposed food who also rated regular foods, five showed a protective effect (positive ratio). However, none of the five subjects with an LFA to exposed cookies showed a positive ratio (protective effect). A median test was performed on the hedonic change ratio. This test also showed that subjects in the novel group exhibited an increase in preference for dietary items and those in the familiar group did not. The median hedonic change ratio was 0. The novel group had positive ratios significantly more often than the familiar group, and the familiar group had negative ratios significantly more often than the novel group (Fisher’s exact test, P = 0.026).

Within the familiar group, significantly more foods decreased than increased in hedonic ratings (Mc Nemar test, P < 0.005). Within the novel group, however, the opposite was true: significantly more foods increased in ratings than decreased in ratings (Mc Nemar test, P < 0.05). The number of foods consumed and the change in ratings are illustrated by Table 3.

**Novel Versus Familiar Food Aversions**

After consuming a novel or familiar food before chemotherapy, aversions to the novel food were significantly more common and stronger than aversions to the familiar food. Table 4 lists subjects’ preference ratios and group means. The novel group’s mean preference ratio (33.75%) indicated an aversion to the exposed food, whereas the familiar group’s mean preference ratio (55.46%) did not.

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**Table 1. Demographic Information by Group**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean age</th>
<th>Sex</th>
<th>Mean no. of chemotherapy treatments</th>
<th>Diagnosis</th>
</tr>
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<tbody>
<tr>
<td>Novel</td>
<td>51.7</td>
<td>11</td>
<td>5.75</td>
<td>B 8 1 2 1 Varied</td>
</tr>
<tr>
<td>Familiar</td>
<td>52.4</td>
<td>11</td>
<td>5.2</td>
<td>H 8 1 1 3 Varied</td>
</tr>
</tbody>
</table>

B: breast carcinoma; H: Hodgkin’s disease; L: other lymphomas; O: other.

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**Table 2. Number of Subjects Showing Scapegoat Effect by Group**

<table>
<thead>
<tr>
<th>Scapegoat effect</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novel group</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Familiar group</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

Fisher’s exact probability test, P = 0.02.

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**Table 3. Number of Foods Consumed After Chemotherapy by Each Group and Changes in These Foods’ Hedonic Ratings**

<table>
<thead>
<tr>
<th>Changes in hedonic ratings</th>
<th>Increased</th>
<th>Decreased</th>
<th>No change</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novel group</td>
<td>22</td>
<td>11</td>
<td>20</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>Familiar group</td>
<td>11</td>
<td>24</td>
<td>22</td>
<td>&lt;0.05*</td>
</tr>
</tbody>
</table>

* Based on McNemar test.
The current results expand on previous work by demonstrating for the first time that in humans the scapegoat effect is specific to novel but not to familiar foods and that a scapegoat food’s effectiveness is due to the development of an LFA to the novel food. Evidence comes from these findings. First, the novel group’s average preference ratio (33.75%) indicated an aversion to the exposed food, whereas the familiar group’s average preference ratio (55.46%) did not. Second, an LFA to novel foods was more common than an LFA to familiar foods. Third, and perhaps most revealing, more subjects who consumed novel halva were protected from aversions to dietary items than those who consumed familiar cookies. In fact, most of the novel group subjects who showed a scapegoat effect also developed aversions to the exposed halva. This evidence suggests that aversions to novel foods can block aversions to familiar foods.

This research also provides evidence that a scapegoat food’s effectiveness is related to the relative ease with which LFA to novel foods are formed. That is, when a novel food and several familiar foods are consumed in proximity to the GI effects of chemotherapy, an aversion is more easily learned to the novel food. The novel food aversion blocks the formation of aversions to familiar foods. But LFA to familiar foods do not seem to block or interfere with other familiar food aversions. When all foods consumed in proximity to chemotherapy’s side effects are familiar, several familiar foods may decrease in preference. Bernstein and Borson proposed a similar mechanism for how LFA may contribute to cancer anorexia by associating malaise with foods in the regular diet.

Our results indicate that subjects who showed an LFA to the familiar exposed food did not show a scapegoat effect. This observation may suggest that individual differences exist that predispose certain people to food aversion conditioning. It may be that when a novel food stimulus is not consumed, these individuals easily develop dislikes for several foods. The above hypothesis is speculative because it is based on five subjects’ data, but it deserves further testing because it may provide insight as to the mechanisms by which some cancer patients show decreased appetite and dislike for certain foods.

The findings that novel group subjects preferred the comparison halva at testing and that the novel and familiar groups’ preference ratio were significantly different are attributed to the development of LFA to the exposed food and not to extraneous factors, such as subjects having disliked exposed halva initially. The following reasons warrant this statement. This study’s procedures and its findings are consistent with conditioned taste aversion theory, and with extensive evidence in animal models and humans that novel food aversions are easier to acquire than familiar food aversions. Additionally, hedonic ratings obtained immediately after consumption of exposed halva at the conditioning trial indicated that six of the nine subjects with LFA rated the exposed halva as 5 (neither like nor dislike) or higher. Finally, if conditioning had not occurred, exposed halva consumption would be expected to increase, as repeated exposures to a novel food increase its acceptability at a later date and not vice versa.
they would otherwise because of a desire to please the experimenter or be socially appropriate, rather than express dislike for the foods that they are offered.

The current results also indicate that scapegoat foods not only prevent aversions to foods in the regular diet but may also increase foods’ palatability. The protective effect of the novel food was manifest in increased ratings for some regular foods consumed after treatment. Within the novel group, significantly more foods increased hedonic ratings than decreased them. The explanation for why an increase in palatability of dietary foods should occur after the development of a novel food aversion is not clear, but animal studies indicate that associating a flavor with recovery from illness leads to increased preference for this flavor. It is possible that acquiring an aversion to a novel food consumed in the prenausea period may facilitate the association of other foods with recovery from nausea.

**Clinical Recommendations**

A recommendation that chemotherapy patients consume a novel food in the medical facility before chemotherapy to reduce the risk of aversions to regular meals has been made. We concur with this recommendation with some modifications. There is reason to believe that scapegoat foods would be effective if consumed away from the medical facility or at times other than before chemotherapy. Forward conditioning is more effective than backward conditioning in learned food aversions. That is, foods consumed before nausea are more easily associated with nausea than foods consumed after nausea. The temporal relationship between the scapegoat and nausea is critical but not the temporal relationship between familiar food and scapegoat. That is, in this study, a scapegoat was effective when consumed before dietary foods, and it was equally effective when presented after consumption of a familiar meal in a previous study. Thus, what should be critical in preventing aversions to regular diet items is that the scapegoat food be consumed any time before the onset of nausea.

It is recommended that patients with postchemotherapy nausea consume a novel food before the onset of nausea. In addition to reducing the number of food aversions or dislikes to regular foods consumed after chemotherapy, this procedure should also increase preference for some of these foods. Effective scapegoat foods may be candy with unusual tastes, unusual flavors of ice cream, ethnic foods such as halva or other foods unfamiliar to patients, a food with a novel seasoning, or any food that is not part of the patients’ regular diet. Developing aversions to these foods should have no deleterious effects on patients’ nutritional status or regular diet, may protect regular foods from aversions, or may even increase preference for some of the foods that are consumed after chemotherapy. This relatively simple intervention should, in turn, improve nutritional status and quality of life.

**REFERENCES**