

Effect of Video Viewing on Food Consumption and Perceived Taste

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Abstract It has been shown that food environments can affect an individual's eating behavior. Moreover, a study reported that most Japanese university students tend to eat food while watching videos. However, it was not determined whether eating habits can be influenced by video viewing, especially when considering certain factors, such as sex differences between those who eat and who appear on video. In our experiments, we used three videos with a duration of 90 seconds: (1) male eating popcorn, (2) female eating popcorn, and (3) just popcorn. It was implemented using two patterns of provision methods: the experiment in succession (Study 1) or on a weekly basis (Study 2). The outcome measures were consumption and perceived taste. The results revealed that no significant difference was observed in consumption and perceived taste regardless of sex difference. After adjusting for perceived satiety, no differences in the results of our experiments of consumption and perceived taste were observed. On the other hand, when conducting our feeding experiments, it was suggested to conduct them once a day to eliminate the effect of perceived taste. It was also suggested that factors other than the kind of video and sex differences may be related to the short-term eating consumption and perceived taste.

Keywords: video viewing, popcorn, taste, consumption, university students

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1. Introduction

Our food consumption is influenced by certain factors, one of which is visual perception. With regard to the same food, the individual's visual perception varies, for example, color, vision, people who eat with someone etc. Previous studies suggested that the perception of the taste of the food may change, even when consuming the same food but different colors [1,2]. These studies also suggested that varying colors may influence sensation, and body temperature, as well as taste, even when consuming the same food.

Moreover, we generally watch something while we eat. Therefore, in this study, we aimed to investigate the influence of video viewing on feeding rate. Previous studies found that the feeding rate increased depending on the type of video viewed, especially footage of people eating [3,4,5]. Subsequently, we conducted our study in relation to those previously published works and checked for similarities and differences.

The originality of our study lies in its emphasis on the differences in outcomes based on sex. It has been demonstrated that women's energy intake changes in response to changes in the sex composition of a group

[6,7]. In addition, Salvy et al, reported that men, but not women, ate more with a same-sex friend than with a stranger; that the sex difference in intake disappeared when subjects were with their romantic partners; and that women, but not men, ate significantly less when with opposite-sex strangers than with their romantic partners [8,9]. Thus, we investigated whether this difference would occur when using both male and female participants. Our hypothesis posited that women would exhibit a lower eating rate when viewing images of men compared to viewing images of women from a previous study's result. Moreover, the food used in the video and the food eaten by the test participants were identical. Furthermore, we divided the experiment schedule into two types: in succession or on a weekly basis. This was because conducting the identical experiment consecutively would affect consumption and perceived taste due to the order.

2. Materials and Methods

2.1.1. Sample and Research Design

This experiment involved 24 students (12 men) who participated in Study 1 and 23 students (11 men) who participated in Study 2. Their age ranged from 20 to 22 years. All participants had good health, no food allergies,

and no history of eating disorders. The age and conditions of the participants were the same in Study 1 and Study 2. The sample size was determined based on a previous study [4,10].

The study protocol was reviewed and approved by the Toyo University Ethical Review Board for Medical and Health Research Involving Human Subjects (TU-2022-009). All participants were briefed on the nature of the study, and their informed consent was obtained.

2.1.2. Sample Procedure

White bowls of salty buttered soy sauce popcorn (Japan Frito-Lay, Ltd., 10 g per bowl, butter soy source taste, 50 kcal per 10 g) were placed on a desk. An alarm bell signaled the start of each tasting period. All participants were served with 10 g of popcorn. The consumption rate was calculated by comparing the initial amount with the remaining amount and they filled out an evaluation of how they felt about the taste. The participants were not informed that they were eating the same popcorn. In Study 1, they ate for a total of 270 s in a day. Study 2 was conducted once a day for 3 weeks. When the participants finished eating the popcorn, they were asked questions about the taste.

Three 90-second videos were used: (1) a video of a man eating popcorn, (2) a video of a woman eating popcorn, and (3) a video of popcorn being placed. The participants and actors in the video were not acquainted and had never met prior. The actors were university students around the same age as the participants. In both experiments, the order of the three types of videos shown to the participants was planned to be randomized. Moreover, all videos had no sound and were presented on a 27-inch monitor. Figure 1 shows the screenshots of the three conditions.



Figure 1. Three scenes in the video clips (A, male eating condition; B, female eating condition; C, only popcorn)

In Study 1, no dietary restrictions were imposed before the experiment. In contrast, in Study 2, the participants had lunch until 13:00 and did not eat anything more until the experiment. Study 1 was conducted between 13:20 and 16:30, whereas Study 2 was conducted between 15:00 and 16:30.

2.1.3. Measurements

After completing all of the eating tests, four questions were asked about their eating habits; “How often do you eat alone?”, “Is your meal time short or long compared to that of your friends”, “Do you eat quickly?” and “Do you watch a screen while eating?” and two questions were asked about popcorn preferences; “Do you like popcorn?” and “How often do you eat popcorn?” [11].

After each experiment, they were asked to answer one question about the tastiness of the popcorn, which was scored using a 6-point likert scale (from “not at all” to “extremely” tasty). The questions reflected the

participants’ evaluations of the popcorn (e.g., “How tasty is the food?”); the higher the score, the more positive the participants’ perception of the food’s tastiness [4,10,12].

2.1.4. Statistical Analysis

Data were expressed as mean $\pm$ standard error or median with a box plot, unless otherwise stated. The statistical analyses were conducted using one-way analysis of variance, two-way analysis of variance, the Kruskal–Wallis test, or the Mann–Whitney U test. The same statistical analyses were performed in both studies.

3. Results

Study 1: The participants’ ratings of the popcorn of consumption ratio in the moving or still images condition were analyzed using ANOVA. The participants’ rating was not significantly both two condition in the moving condition ($M=23.6$, $SE=1.8$) and in still images ($M=22.0$, $SE=2.9$). The participants’ perceived taste of the popcorn in each condition was analyzed using the Kruskal–Wallis test. Moreover, the participants’ perceived taste of popcorn were not significant in relation to the moving or still images (Figure 2). The participants’ perceived taste of popcorn scoring was not significantly between two conditions in the moving condition ($M=4.8$, $SE=0.1$) and still images ($M=4.7$, $SE=0.1$).

In the next analysis, the results reflected the popcorn consumption and perceived taste among male and female participants (Figure 3). The participants’ rating of the popcorn of consumption was not significant differences in the male eating condition during a video of male eating popcorn ($M=28.4$, $SE=3.8$), the male eating condition during a video of female eating popcorn ($M=23.9$, $SE=3.8$), and the male eating condition in a video of popcorn being placed ($M=24.7$, $SE=3.8$). The participants’ rating of the popcorn of consumption was not significant differences in the female eating condition during a video of male eating popcorn ($M=20.9$, $SE=3.8$), the female eating condition during a video of female eating popcorn ($M=21.0$, $SE=3.8$) and the female eating condition in a video of popcorn being placed ($M=19.3$, $SE=3.8$).

The participants’ points of perceived taste was not significant differences in the male eating condition during a video of male eating popcorn ($M=4.8$, $SE=0.2$), the male eating condition during a video of female eating popcorn ($M=4.6$, $SE=0.2$) and the male eating condition in a video of popcorn being placed ($M=4.8$, $SE=0.2$). The participants’ points of perceived taste was not significant differences in the female eating condition during a video of male eating popcorn ($M=4.8$, $SE=0.2$), the female eating condition during a video of female eating popcorn ($M=4.8$, $SE=0.2$) and the female eating condition in a video of popcorn being placed ($M=4.6$, $SE=0.2$).

The test validates the relationship between popcorn consumption ratio and taste perception based on the order of tests. The popcorn consumption was not significant related by the order of tests (N.S, Figure 4). The participant’s rating of the consumption of the popcorn was significantly higher in the first condition ($M=21.2$, $SE=2.7$), the second condition ($M=23.5$, $SE=2.4$) and the third condition ($M=24.5$, $SE=2.9$). On the other hands, the

results indicate a significant difference in taste perception by the order of tests ($p < 0.05$, Figure 4). The points of the perceived taste of the popcorn was significantly higher in the first condition ($M=5.1$, $SE=0.1$), the second condition ($M=4.7$, $SE=0.1$) and the third condition ($M=4.5$, $SE=0.1$). As the test progressed, the taste points decreased significantly. Therefore, the most important data from this study, taste perception suggested that by order is one factor.

Study 2: Figure 5 shows the effects of the videos and still images. The difference with Figure 2 was that was conducted with the experiment on a different day. The participants' ratings of the popcorn of consumption ratio in the moving or still images condition were analyzed using ANOVA. The participants' rating was not significantly both two condition in the moving condition ($M=35.6$, $SE=2.4$) and in still images ($M=34.6$, $SE=3.9$). The participants' perceived taste of the popcorn in each condition was analyzed using the Kruskal–Wallis test. Moreover, the participants' perceived taste of popcorn were not significant in relation to the moving or still images (Figure 5). The participants' perceived taste of popcorn scoring was not significantly both two condition in the moving condition ($M=4.9$, $SE=0.1$) than in still images ($M=4.7$, $SE=0.2$).

Figure 6 further illustrates the disparities between sexes concerning both the videos and the participants. The results reflected the popcorn consumption and perceived taste among male and female participants (Figure 6). The participants' rating of the popcorn of consumption was not significant differences in the male eating condition during a video of male eating popcorn ($M=32.8$, $SE=4.4$), the male eating condition during a video of female eating popcorn ($M=34.3$, $SE=5.8$), and the male eating condition in a video of popcorn being placed ($M=33.5$, $SE=6.7$). The participants' rating was not significant differences in the female eating condition during a video of male eating

popcorn ($M=35.8$, $SE=4.4$), the female eating condition during a video of female eating popcorn ($M=39.1$, $SE=16.4$) and the female eating condition in a video of popcorn being placed ($M=35.5$, $SE=16.4$).

The participants' points of perceived taste was not significant differences in the male eating condition during a video of male eating popcorn ($M=5.0$, $SE=0.3$), the male eating condition during a video of female eating popcorn ($M=4.7$, $SE=0.3$) and the male eating condition in a video of popcorn being placed ($M=4.5$, $SE=0.2$). The participants' points of perceived taste was not significant differences in the female eating condition during a video of male eating popcorn ($M=4.8$, $SE=0.3$), the female eating condition during a video of female eating popcorn ($M=5.2$, $SE=0.3$) and the female eating condition in a video of popcorn being placed ($M=4.9$, $SE=0.3$).

Figure 7 shows the result of an experiment conducted once a day for 3 weeks (Figure 7). To contrast with consecutive exam on the same day, the tested three times in a row, the taste significantly decreased (Figure 4).

The test validates the relationship between popcorn consumption ratio and taste perception based on the order of tests. The popcorn consumption was not significant related by the order of tests (N.S, Figure 7). The participant's rating of the consumption of the popcorn was not significant difference in the first condition ($M=33.0$, $SE=4.1$), the second condition ($M=34.6$, $SE=3.3$) and the third condition ($M=37.8$, $SE=16.1$). On the other hands, the results indicate a significant difference in taste perception by the order of tests (N.S, Figure 7). The points of the perceived taste of the popcorn was significantly higher in the first condition ($M=4.8$, $SE=0.2$), the second condition ($M=4.9$, $SE=0.2$) and the third condition ($M=4.7$, $SE=0.9$). As the test progressed, the taste points decreased significantly. Therefore, the most important data from this study, taste perception suggested that by order is one factor.

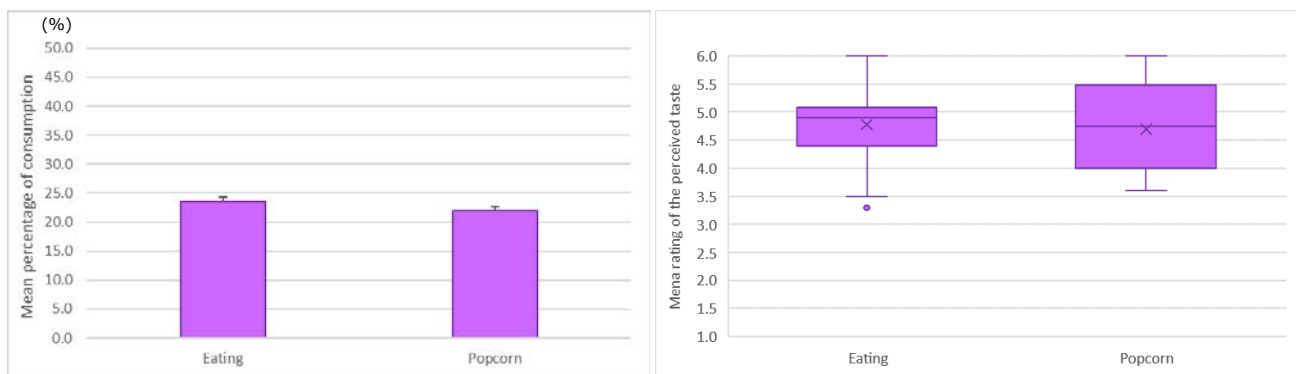


Figure 2. Average consumption and perceived taste of the popcorn according to image composition in the same-day experiment. The error bars represent the standard error of the mean

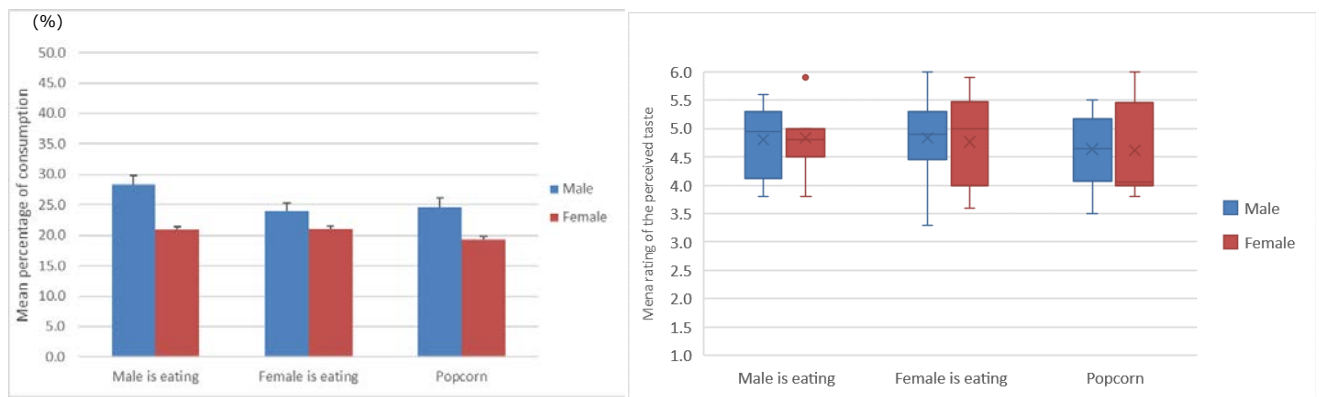


Figure 3. Average consumption and perceived taste of the popcorn according to image and sex composition in the same-day experiment. The error bars represent the standard error of the mean

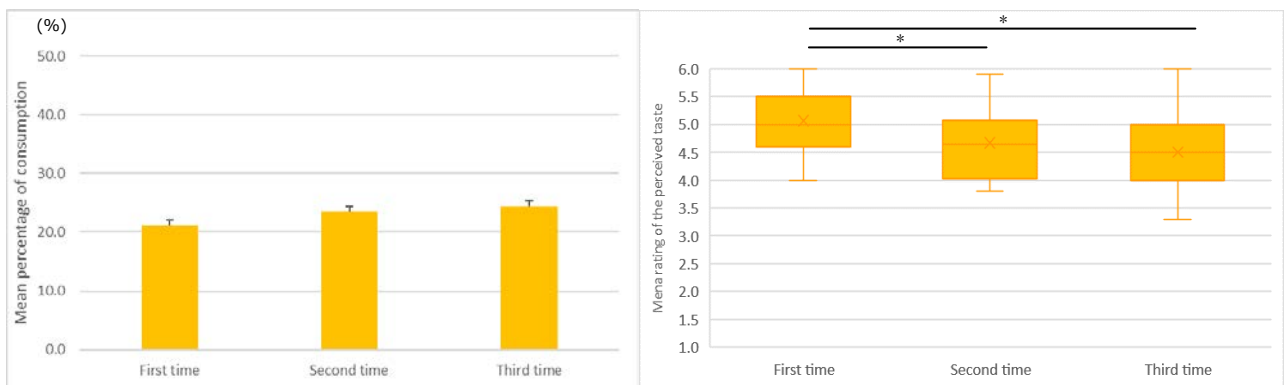


Figure 4. Average consumption and perceived taste of the popcorn according to order of experiment of three times in the same-day experiment. The error bars represent the standard error of the mean. The vertical bars represent the standard errors. The asterisks show p values of < 0.05.

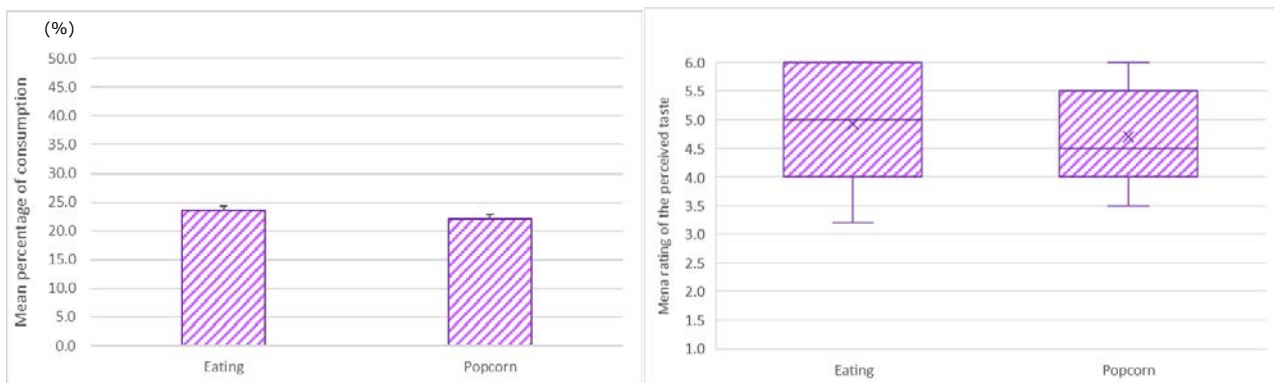


Figure 5. Average consumption and perceived taste of the popcorn according to image composition in the different week experiments. The error bars represent the standard error of the mean.

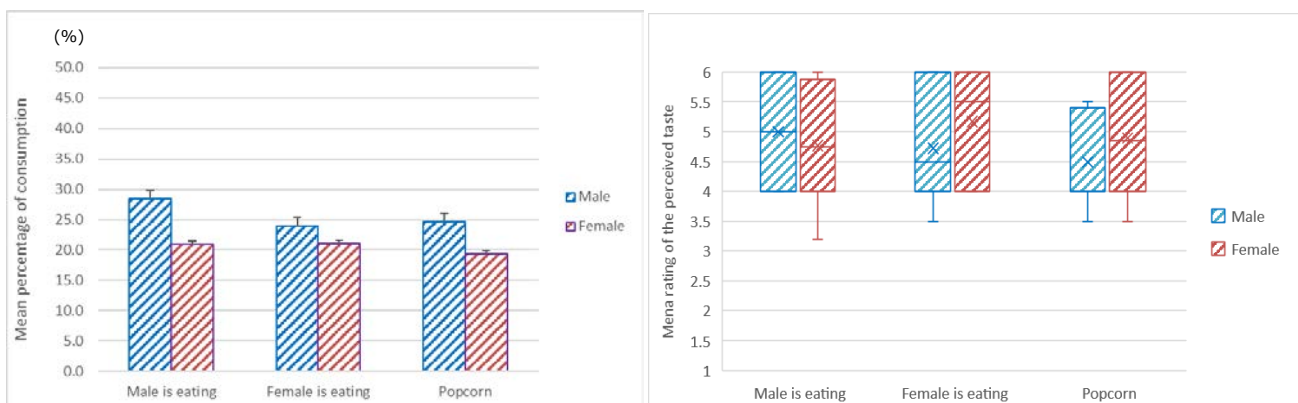


Figure 6. Average consumption and perceived taste of the popcorn according to image and sex composition in the different week experiments. The error bars represent the standard error of the mean

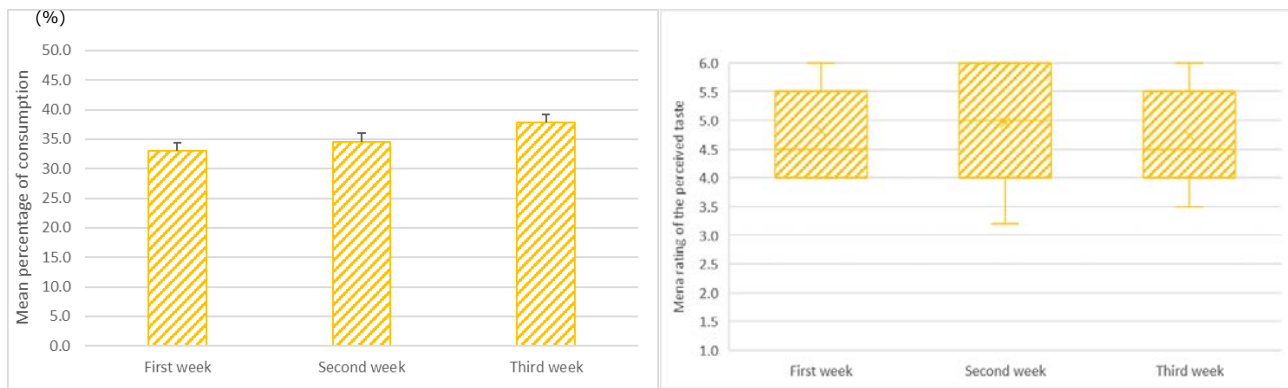


Figure 7. Average consumption and perceived taste of the popcorn according to order of experiment of three times in the different week experiments. The error bars represent the standard error of the mean

4. Discussion

This experiment revealed that the sex of the participant or the type of video did not affect the taste of the popcorn or the participant's feeding rate (Figures 3 and 6). Furthermore, we found that it was better to conduct the experiments at intervals rather than in a continuous manner (Figures 4 and 7).

We were able to make significant observations under these experimental conditions. It was suggested that feeding the participants three times in a row affected taste perception, although this was different from the main purpose of the experiment. When a person continued to eat the same food for 2 min, they experienced a feeling of satiety, which gradually caused them to feel uncomfortable about the food [13]. This result was similarly supported by the present study as shown in Figure 4 ($p < 0.05$). Considering this result, we thought that conducting this experiment three times in a row would affect the consumption and perceived taste of the popcorn. When we tested the two types of plans to conduct the same experiment for 3 weeks, the effect on palatability disappeared (Figures 4 and 7). With regard to the feeding experiments, it became clear that conducting them at intervals is better than doing in a continuous manner during short time condition.

The moving and still images did not affect eating rate or palatability (Figures 2 and 5). These analyses should facilitate the observation of the effects of modeling [14]. However, that effect was not achieved either. Moreover, it was not determined why the type of video and sex of the participant did not affect food consumption and perceived taste (Figures 3 and 6). When a number of men and women eating face-to-face, a significant **increase** in their food consumption was observed [7], but this effect could not be confirmed by the video. There was another reason for the hypothesis: compared with eating alone, the eating rates were higher when watching TV and eating with friends [15]. Therefore, we assumed that we would get the same results, but this was not the case of this study. We believe this **was** due to the differing experimental styles, particularly regarding the food and images being consumed.

Furthermore, in exploring the impact of dietary contexts on people, the influence of auditory cues on eating behavior has been investigated in recent studies. This time it was conducted without sound [16,17]. As for hearing, it

was found that among young children eating in cafeterias, increased noise levels may decrease the consumption of fruits and vegetables during a school lunch meal [18]. In the future, we aim to conduct further studies incorporating various conditions. Based on the findings of this study, we hope to implement the optimal conditions that are conducive to the increase or decrease in intake and taste by changing the environment.

In conclusion, it was suggested that factors other than the kind of video and sex differences may be related to the short-term eating consumption and perceived taste. Our study recommended that when conducting experiments on feeding, we had better conduct them once a day to eliminate the effect of eating on perceived taste.

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Contributors

TO designed the study and the analyzed the data. NK advised the protocol and the statistical analysis. TO wrote the manuscript and NK has approved the final manuscript.

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Declaration of interest statement

Declare conflicts of interest or state "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interest that may be perceived as inappropriately influencing the representation or interpretation of reported research results.

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