



## **Interactions Between Forms of Fat Consumption and Restaurant Bread Consumption\***

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### **Abstract**

How does fat consumption influence the consumption of companion foods such as bread? Adult restaurant goers who were randomly given olive oil for their bread used 26% more oil on each piece of bread compared to those who were given block butter, but they ended up eating 23% less bread in total. This finding illustrates one way in which fat intake can interact with the consumption of companion foods.

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## Interactions Between Forms of Fat Consumption and Restaurant Bread Consumption

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### Introduction

While olive oil is often noted as a healthful alternative to using butter on bread, any advantages could be negated if people unknowingly over-consumed it. Its relative novelty (1), its liquid form (2), or its taste (3) might all contribute to it being over-consumed. There is little evidence about the relative consumption tendencies of olive oil and butter in natural environments, nor do we know how their consumption will influence the consumption of companion foods such as bread.

### Methods

15 In a controlled field study, the volume of olive oil consumed during a restaurant visit was compared with the amount of butter consumed. The study was conducted on three consecutive evenings in an Italian restaurant in Champaign, IL (n=215) and on two consecutive evenings in an Italian restaurant in Lebanon, NH (n=126). When diners arrived at each restaurant, each was randomly provided either a small dish of 66 grams of olive oil or a half stick (66 grams) of soft block butter next to their plate. Care was taken that all of those at the same table were given either butter or olive oil (but not both). Six pieces of similar-sized machine-cut Italian bread were given to each diner on a small oblong plate that was also to serve as their bread plate. While the olive oil and butter was carefully pre-weighed, efforts to systematically pre-weigh the bread on each plate eventually proved unnecessary because of the modest variance in weight. The age range of the majority of the restaurant patrons was between 20 and 55 with a similar mix of males and females.<sup>1</sup>

20 After the diners left the restaurant, the remaining butter or olive oil was weighed along with the bread and along with any plate waste. The average amount of butter or oil consumed per person was calculated by subtracting the amount of unused olive oil or butter each individual left on the table from the amount at the beginning of the study.<sup>2</sup>

### Results

In analyzing the data, ANCOVAs were conducted using the day of the week (Wednesday, Thursday, or Friday) and the restaurant's location (IL or NH) as covariates.<sup>3</sup>

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<sup>1</sup> Consistent with the guidelines approved by the Human Subjects Committee and the Institutional Review Board at the University of Illinois and previously at Dartmouth College, diners were asked to participate in a what was vaguely described as a "restaurant study." Their permission was obtained prior to being seated, and the 94% who agreed to be in the study were unaware we were studying their consumption until debriefed after their meal.

<sup>2</sup> The results of this study are consistent with a previous study that used 226 grams of total fat per table was conducted by measuring the average usage per table (instead of usage per individual).

<sup>3</sup> The data were analyzed using both total consumption per table and average consumption per individual as the levels of analysis. Because the statistical results are consistent, data are reported using the individual as the unit of analysis.

The results in **Table 1** indicate that diners who were given olive oil for their bread ate more calories on each slice of bread than those given butter ( $F_{1,301} = 4.53$ ;  $p < .05$ ). For each piece of Italian bread they ate (approximately 339.1 Joules/slice), the average diner ate 4.4 grams of oil (less than a teaspoon). For those who were served butter, the amount of butter eaten per piece of bread was 3.7 grams (less than a conventional-sized pat).

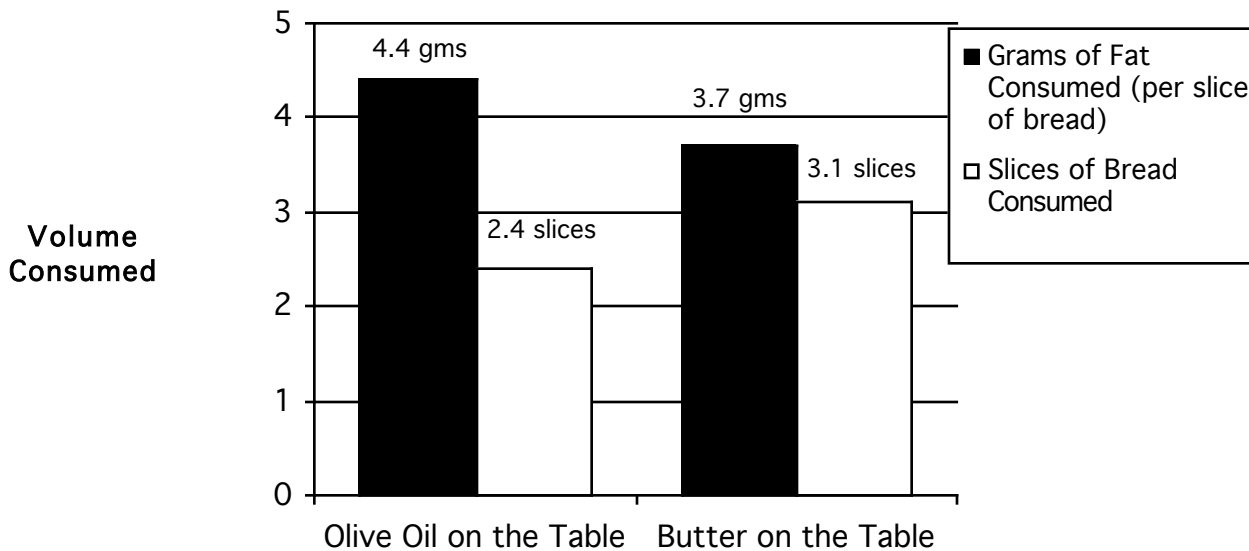
**Table 1.**  
**The Impact of Olive Oil vs. Butter on Bread and Fat Consumption**

	Olive Oil	Butter	F-Test/p-value
Grams Consumed per Slice of Bread*	4.4 grams	3.7 grams	4.53/p = .02
Energy Intake per Slice of Bread*	167.6 Joules	138.3 Joules	4.53/p = .02
Slices of Bread Consumed*	2.4 slices	3.1 slices	5.22/p = .01
Total Bread Consumed*	703.9 Joules	909.2 Joules	5.22/p = .01
Total Oil or Butter Consumed	402.2 Joules	427.4 Joules	.82/p = .89
Total Energy Intake*	1106.2 Joules	1336.6 Joules	6.13/p = .006

\*  $p < .05$ .

What is more notably illustrated in **Figure 1**, however, is that even though more olive oil is used on each slice of bread than butter, people eating olive oil ate fewer pieces of bread (2.4 vs. 3.1 slices;  $F_{1,301} = 5.22$ ;  $p < .05$ ). The resulting difference in energy intake (703.9 vs. 909.2 J) shows that one key trade-off between olive oil and butter may not be in fat calories, but may be in total bread calories. With respect to total energy intake, olive oil eaters consumed 1106.2 J (703.9 J of bread plus 402.2 J of olive oil), but butter eaters ate 1336.6 J (909.2 J of bread plus 427.4 J of butter), which was 220.4 J more than olive oil.

**Figure 1.**  
**Who Eats More? Olive Oil vs. Butter on the Restaurant Table**



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While people given butter consume less fat per slice of bread, they consume more bread and more total energy. Both groups consumed similar amounts of olive oil and butter, but this was for different reasons. People eating olive oil ate 26% more on each piece of bread than those consuming butter (4.4 grams vs. 3.7 grams), but they also ate 23% less bread. In terms of total energy distribution, those eating olive oil consumed 36.6% of their energy in the form of fat compared to 31.0% of those consuming butter.

Exit interviews were conducted in the restaurant's parking lot on the last day of the study with 117 of the diners in Champaign, IL. At this point, results from the first two days had been preliminarily analyzed. The 64 diners who had been given olive oil on this last evening were asked if they thought they had eaten more "fat calories" than if they had otherwise been given butter. Thirty-one (48%) believed that they had eaten more fat calories and had done so because olive oil was somewhat novel, because it tasted more rich and filling, or because it was difficult to control or to monitor how much was placed on each piece of bread ("it soaks up fast").

While there is mixed evidence as to the degree that different fats have differing degrees of satiation (4), 16 of these 31 diners mentioned the oil as more being "more filling." This reasonably common casual observation may merit further study investigating the relationship between perceived and actual satiation.

When conducting exit interviews with the 53 diners who had been given butter, they were asked to estimate how much bread they had eaten. Subsequent analyses indicated they underestimated their consumption by an average of 0.6 slices. This underestimation tendency is a consistent and well-documented phenomenon in consumption research (5), often occurring because most adults simply do not monitor their consumption and are unaware of the forces that influence them (6).

### Conclusion

When people are given olive oil in a restaurant, they consumed 26% more on each piece of bread than those given block butter, but they ended up consuming 23% less bread in total. In addition, they consumed a higher percentage of their calories in fat (36.6 vs. 31.0%) but had a lower level of total energy intake (1106.2 vs. 1336.6 J).

This study examined only bread and fat consumption and not energy intake across the entire meal. Its findings, however, provide a novel look at a traditional dietary recommendation: When considering the obesity-related aspects of a diet, one needs to focus not only on fat-related energy intake, but also on total energy intake. By eating less fat, one can unknowingly eat more carbohydrates – eating twice as many low-fat cookies trades off fat intake for an increased intake of carbohydrates. When focusing on the consumption of a target food, it important to also examine how that food influences the consumption of companion foods.

### References

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