Scientific Study on harmonization of Pasta and Pasta Sauce

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In this study, the quality of pasta mixed with tomato sauce was physically and chemically evaluated. Dried pasta samples (1.7±0.3mm) were boiled for three different boiling times: 6.5 (sample A), 8.5 (sample B), and 11 min (sample C), before being immersed in tomato sauce. As a boiling time of 8.5 min produced *al dente* pasta (sample B), we here defined this sample as the most suitable for eating. The boiling time did not affect pasta appearance of pasta with sauce, weight of the absorbed sauce, pH, or NaCl concentration. Although the boiling time affected the weight of retained sauce, specifically the adhered sauce, and the moisture content, these factors were not related to the suitability of boiled pasta with tomato sauce for eating. The physical properties of the pasta boiled for the shortest time (sample A) changed greatly after sauce addition. The change in the peak force in the force–strain curve after sauce addition was the largest for the pasta sample boiled for the shortest time. Additionally, the breakdown force of the pasta boiled for the shortest time was large. It is not preferable that the texture of pasta changes gradually after it is boiled. The texture of boiled pasta is not stable when the contained starch granules are not fully gelatinized by boiling. The results of T_2 and Cl distribution measurements suggested that the degree of penetration of the sauce ingredients to the core of the pasta boiled for the shortest time (sample A) was less than that of the pasta boiled for the longest time. Although there were no significant differences among the weights of the absorbed sauce with boiled pasta samples, the degree of penetration of the sauce ingredients to the core of the pasta was different. The moisture and the other ingredients in the sauce might not move together in the pasta. So, more sauce ingredients such as NaCl might penetrate in the pasta boiled for long time (sample C), whose moisture content was high, than in the pasta boiled for short time (sample A), even though there were no significant differences in the weights of absorbed sauce among all samples. It seems that it is not the total quantity of absorbed sauce, but the distribution or homogeneousness of the sauce ingredients that is a critical factor in the suitability of boiled pasta with tomato sauce for eating. If there were only adhered sauce, we would experience a less complex taste during mastication. On the other hand, we would suitably experience the combined taste of adhered sauce and penetrated sauce with the taste of pasta if the sauce ingredients penetrated to the core.

The following two factors were found to greatly affect the suitability of boiled pasta with tomato sauce for eating with different boiling times.

1) Stability of physical properties of pasta after sauce addition.

2) Sufficient penetration of sauce ingredients to the core of pasta.

In this study, the relationship between pasta and pasta sauce was physically and chemically investigated for the first time. The conclusions reached in this study may contribute to quality improvement of pasta products and market reinvigoration by providing guidelines for introducing pasta cooking methods designed to optimize flavor and texture and helping food producers to develop new products. The tomato sauce used in this study is typical, though a wide variety of tomato sauces exist. Therefore, the range of suitable qualities of pasta will change according to variation in the quality of the tomato sauce. Future work will consider whether the knowledge obtained in this study can be applied to different pairings of sauce and pasta.