A Research Note

Comparative Study of the Stomacher and the Waring Blender for Homogenization of High-Fat Dairy Foods

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ABSTRACT

There were no differences between conventional aerobic plate counts on high-fat dairy food products after homogenization 2 min in either a Stomacher 400 or a Semi-Micro Waring blender.

The Colworth Stomacher is effective in preparation of food homogenates (3, 7, 8, 9). Some reports, however, have indicated that the device produces homogenates that are not equivalent to those produced by high-speed shear blenders (1, 11, 12). Most problems with the Stomacher have been associated with high-fat foods (1, 7, 8). In this study, we compared homogenates produced by the Stomacher with those produced by a Waring blender.

MATERIALS AND METHODS

Stomacher

A Stomacher 400 (Cooke Lab. Products, 900 States Lane, Alexandria, Virginia 22314) was used. Eleven grams of sample and 99 ml of phosphate diluent were placed in the 18 x 30-cm polyethylene bags which were then locked into the machine jaws and the mixture was blended for 2 min.

Blender

A 250-ml maximum working capacity. Semi-Micro, stainless steel blender container assembly was driven by a conventional two-speed Waring blender base. Glass 1000-1200 ml containers were also evaluated. The containers were cleaned and sterilized at 121 C for 15 min in an autoclave and cooled to ambient temperatures between samples. Homogenates of the foods were prepared by weighing an 11.0-g sample into the container, adding 99 ml of diluent and blending at high speed for 2 min. Cheese samples, containers and 2% citrate diluents were prewarmed to 40 C before blending in either the Stomacher or Waring blender.

Diluents

Phosphate buffers (without MgSO4) were used on all samples except where hard cheese samples required citrate diluent (5). Diluents were used at 25 C, except where Standard Methods suggested heating to 40 C (5).

Plate count

The Spiral Plate Count (SPLPC) was determined on the samples after homogenization (5). A model A Spiral Plater (Spiral Systems Marketing, 1200 Quince Orchard Blvd., Gaithersburg, Maryland 20760) and DIFCO (P.O. Box 1058 A, Detroit, Michigan 48232) Standard Plate Count agar were used.

Homogenates

Each food product was made into homogenates, using both Stomacher and blender techniques on 10 separate days. Duplicate SPLPC plates were prepared of each dilution. An analysis of variance was conducted on the logarithms of the SPLPC data.

High-fat dairy foods

Food samples were selected which contained ingredients that would be difficult to homogenize. Monterey cheese, containing caraway seeds and peppers, was selected. Pecans, cherries and walnuts were added to ice cream samples to increase the flora and homogenization difficulty. A salad mixture was prepared incorporating cream cheese, lettuce, carrots and 17%-fat avocados. A 1000-g quantity of each food product was tempered to allow sufficient incorporation of additives in a Sunbeam food processor to provide uniform distribution of particulate matter and microflora. The mixture was then distributed into ten B-991 60-ml Whirplac bags (NASCO, 901 Janesville Ave., Fort Atkinson, Wisconsin 53538) which were tied and stored at -20 C until thawed for homogenization. The longest period from freezing to plating was 30 days.

RESULTS

Cheddar cheese homogenates (5), prepared with the two homogenizers, were allowed to settle for 48 h in 250-ml graduated cylinders at 4 C to note any visual differences in sedimentation characteristics. Additionally, homogenates were filtered through various mesh screen systems. No differences in results due to method of homogenization could be detected using either technique.

Aerobic plate count data on the various dairy foods products are shown in Table 1. The SPLPCs were identical for the Cheddar cheese sample and were slightly higher for all of the blended samples except in the 33% fat whey cream, where the count was higher for the stomached sample. The whey cream churned in the blender but not in the Stomacher. Significant differences in results characterized the various trials, however, there were no significant differences between the methods of homogenization.
Diluent placed in the Stomacher (110 ml) at 40°C dropped 9-12°C in container walls. Diluent and no particulate matter remained upon the samples using the plastic bag method (5, p. 162-163) (13).

**DISCUSSION**

Evaluation of a new homogenization device is difficult in the absence of objective methods for assessing homogenates. Blender speeds, temperatures, bowl sizes and configurations and sample/diluent volumes vary considerably (2, 5, 10). Homogenate quality and blending cycles appear to be purely subjective. The size of the blender container should be specified in Standard Methods. In our preliminary work, we used a 1-liter blender container with 11 g of cheese sample and 99 ml of diluent (5, p. 162) and were unable to obtain a satisfactory homogenate. Much of the sample remained as particulate matter on the sides of the vessel. Leakage during inversion prompted use of a rubber policeman. The Semi-Micro blender container produced a visually acceptable homogenate with the same size sample/diluent size. No rinsing is needed to wash sample into the blender container produced a visually acceptable homogenate with the same size sample/diluent size. No rinsing is needed to wash sample into the blender container.

The design of the Stomacher precludes particulate matter from escaping the sponging/squeezing action of the steel paddles. Therefore, with the proper sample/diluent size, no rinsing is needed to wash sample into the homogenizer jaws, nor is there a chance of sample loss through container inversion. The homogenizing action resembles that approved for preparation of hard cheese samples using the plastic bag method (5, p. 162-163) (13).

We found the mean SPLPC identical on the Cheddar cheese sample (Table 1), and slightly higher in all of the blended samples except in whey cream where the count was higher for the stomached sample. The latter sample did not churn and therefore could have allowed greater bacterial dispersion. The differences were not statistically different between homogenizers; therefore, we cannot recommend that a bias must be used with specific dairy foods. Greater variation was associated with collecting, preparing and plating samples on different days than between the homogenization methods (4).

Sharpe et al. (9) found that most foods filtered better following stomaching than when osterized. However, some foods including processed cheese and whole and nonfat dry milk needed protease or emulsifier treatment to improve filtration following stomaching. Modification of blending conditions, as used herein, may also help to improve equality between methods where problems are found. Many workers have used 30 sec of stomaching while Stomacher descriptive materials suggest, “All high-fat content meats, pastry and other foods require 2 min stomaching” (Bulletin: Colworth Stomacher Uses. Cook Lab. Products).

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**REFERENCES**