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Yogurt — A Compositional Survey in the Greater Lansing Area[1]

M. L. RICHMOND, R. C. CHANDAN* and C. M. STINE

Department of Food Science and Human Nutrition, Michigan State University, East Lansing, Michigan 48824

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ABSTRACT

Prompted by numerous consumer inquiries and several reports in the literature, this survey was undertaken to monitor the composition of yogurt in the mid-Michigan market. Forty-seven samples representing six brands were analyzed. Mean values ± standard deviation for the content of protein (Kjeldahl), fat (Mojonnier) and total solids (Mojonnier), pH and net weights were measured. The data are presented by product category, i.e. low-fat flavored, low-fat plain, full-fat flavored, full-fat plain, and cumulated for all samples. Wide variations in chemical composition were observed between and within brands surveyed. Mean values for all flavored samples surveyed (N = 42) were 4.34% protein, 2.34% fat, 25.88% total solids and 4.01 pH. Corresponding values for all plain samples surveyed were 5.68, 2.86, 16.90 and 4.23, respectively. The data show that 25% of all samples analyzed were greater than 6.6% overweight while 10.6% of the yogurts surveyed weighed less than the declared container net weight. Caloric values for flavored yogurts ranged widely. Mean caloric values for flavored, low-fat and full-fat brands were 106 and 121 cal/100 g, respectively. In general, the results indicate that commercial yogurt would benefit from closer composition control.

Yogurt consumption in the United States has increased from 0.11 lb per capita in 1955 to 2.80 lbs per capita by 1977, an increase of nearly 2500%. From 1970-1976 the per capita consumption increased 170% (*4*). In 1976, total sales of yogurt were estimated at 510 million pounds (*9*) and annual sales for 1977 exceeded 600 million pounds (*1*). Initial projections for 1978 indicate that about 0.5% of all fluid milk produced in the U.S. will go into yogurt manufacture (*2*).

Previous yogurt surveys have shown wide variation in the chemical composition of commercial yogurts. Duitschaever et al. (*6*) surveyed 152 yogurts in Ontario, Canada and found that yogurt of uniform composition was generally not available. It was further stated that this was evident both between and within brands surveyed. Net weights ranged widely with a mean overfill of 7.2%. The pH values varied from 3.27-4.53 with a mean value of 3.91. In 1973, Kroger and Weaver (*7*) surveyed commercial yogurts in the Central Pennsylvania area (41 fruit and 3 plain) and found constant overfill to be a major problem in this region also. Samples surveyed were inconsistent in terms of product net weights, with a mean overfill of 6.87%. Also noted in this survey were wide variations in protein, fat, total solids, pH and caloric content. In yet another survey of yogurts in the United Kingdom (*5*), the data revealed appreciable differences in net weight, pH, total solids, fat, protein, ash and sugar content. The survey reported in this paper was made recently in the Greater Lansing Area to assess the chemical composition of various yogurts from commercial markets with the objective of making available meaningful data for use by the industry.

MATERIALS AND METHODS

Samples

Forty-seven samples, encompassing six major brands, were analyzed for total protein, fat, total solids, pH, net weight and caloric content. The samples were purchased in the Greater Lansing area (near MSU) and included both Sundae- and Swiss-style yogurts.

Sample preparation

All containers were weighed to determine their gross weight. The contents were then transferred quantitatively to a Waring blender and mixed at high speed for 3 min to achieve homogeneity (*6,7*) for subsequent analyses.

Product net weight

The gross container weights (yogurt + container) were determined using a Mettler P1000 balance. After transferring and blending as mentioned earlier, the containers, including tops, were rinsed with distilled water and air-dried. The containers were then reweighed and this value was subtracted from the gross weight to obtain the corresponding net weights.

Protein content

Total protein was determined by an official AOAC Kjeldahl method. The factor 6.38 was used in conversion of reduced nitrogen values to protein (*3*). All chemical analyses were done in duplicate.

Fat content

Percentage fat was determined by the Mojonnier modification of the Roese-Gottlieb extraction (*8*).

Total solids

Percentage total solids was determined by the Mojonnier vacuum oven procedure (*8*).

pH

pH of the yogurt samples was measured using a digital pH meter equipped with glass and calomel electrodes (Chemtrix Model 60A). A buffer solution of pH = 4.01 was used for scale calibration.

Caloric content

The caloric value of each sample was determined by calculation as suggested by Kroger and Weaver (*7*), with a slight modification. Calories/100 g = % fat × 8.79 + [% total solids − (% fat + ash)] × 4. Mean ash contents of flavored yogurt and plain yogurt were experimentally determined to be 1.02 and 0.93%, respectively (*10*).

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RESULTS AND DISCUSSION

The results presented herein show mean values plus or minus standard deviation for various parameters. A total of 47 individual samples were analyzed, of which 28 were fruit-flavored. Due to the lower consumption of plain yogurt, only five different commercial brands were available.

Composition of various brands of low-fat flavored yogurt

Examination of the data collected on composition of flavored yogurt reveals considerable variation of a single constitutent within a particular brand. These variations range from wide to minimal and should therefore be of concern from an industrial quality control standpoint. There was also wide variation found in the composition between brands. With low-fat fruit flavored yogurt dominating the market (75-90% of total yogurt sales in the U.S.), it is noteworthy to point out that Brand II (Table 1) ranged widely in terms of its chemical composition; 3.68-4.42% protein, 1.29-1.63% fat, 21.84-27.02% total solids and 3.77-4.14 pH. In terms of the chemical composition, these data are representative of the other brands tested.

TABLE 1. *Chemical composition of various brands of low-fat flavored yogurt*[a].

Product category	Protein (%)	Fat (%)	Total solids (%)	pH
Brand I (N = 5)	4.36 ± 0.22	1.60 ± 0.05	24.80 ± 3.13	4.14 ± 0.11
Brand II (N = 13)	3.97 ± 0.23	1.45 ± 0.10	25.26 ± 1.72	3.98 ± 0.11
Brand IV (N = 6)	4.74 ± 0.08	1.37 ± 0.05	27.25 ± 0.95	4.27 ± 0.11
Brand V (N = 4)	4.33 ± 0.04	2.20 ± 0.13	25.58 ± 1.65	3.99 ± 0.06

[a]Mean ± standard deviation.

The values obtained for full-fat yogurts (not shown) showed wide variation in fat content. The mean values for percent fat of the two brands surveyed were 2.98 and 4.90% with a range of 2.39 to 5.32%. The mean pH of these samples was less than 4.00.

Composition of flavored yogurt

The data in Table 2 compare the mean values of all flavored yogurts, including both low and full-fat brands. These data for low-fat fruit flavored yogurt are in general accord with the published values from Handbook 8-1 (*10*). However, Handbook 8-1 gives values for all types of yogurt except full-fat fruit flavored yogurt. Therefore, no general comparisons can be made for full-fat flavored yogurts. It would seem advisable, with increasing production and consumption of yogurt in the U.S., to make available in the future published data on full-fat flavored yogurt.

TABLE 2. *Chemical composition of various flavored yogurts*[a].

Product category	Protein (%)	Fat (%)	Total solids (%)	pH
Low fat yogurt (N = 28)	4.26 ± 0.35	1.56 ± 0.28	25.83 ± 2.17	4.07 ± 0.16
Full fat yogurt (N = 14)	4.51 ± 0.18	4.01 ± 1.00	26.39 ± 1.58	3.88 ± 0.13
All samples (N = 42)	4.34 ± 0.33	2.34 ± 1.29	25.88 ± 1.99	4.01 ± 0.17

[a]Mean ± standard deviation.

In comparing the data in Table 2, one finds that in addition to the higher fat content, protein and total solids content were also found to be greater in the full-fat brands analyzed. The pH values were comparatively different; the mean pH of full-fat products was 3.88 compared to an average of 4.07 for the low-fat yogurt.

Composition of plain yogurt

Both full- and low-fat plain yogurts surveyed (Table 3) were similar in protein content. Mean values for percent fat, percent total solids and pH were all found to be greater in the full-fat yogurts.

TABLE 3. *Chemical composition of various brands of plain yogurt*[a].

Product category	Protein (%)	Fat (%)	Total solids (%)	pH
Low fat yogurt (N = 3)	5.69 ± 0.73	1.62 ± 0.04	16.25 ± 1.01	4.22 ± 0.17
Full fat yogurt (N = 2)	5.66 ± 0.24	4.71 ± 1.54	17.88 ± 2.61	4.26 ± 0.35
All samples (N = 5)	5.68 ± 0.58	2.86 ± 1.79	16.90 ± 1.99	4.23 ± 0.26

[a]Mean ± standard deviation.

In comparing the data for low-fat flavored and low-fat plain (Table 2 vs. Table 3) the results indicated higher pH, protein and fat content in the low-fat plain yogurt while the flavored low-fat yogurts had larger values for percent total solids. The results were similar for full-fat yogurts (flavored vs. plain) in that pH, protein and fat content were all found to be greater in the plain full-fat yogurt samples analyzed. Mean total solids contents were greater in the full-fat flavored yogurts as would be expected, and mean pH values for full-fat flavored yogurts were notably less than for full-fat plain yogurt.

Net weights of flavored low-fat yogurt

Net weights are shown in Table 4. Overweight seemed to be a common denominator of low-fat flavored yogurt (actually of most yogurt examined) with a mean value for the 28 yogurts surveyed being nearly 5% overweight. Brand I had a mean net product overweight of about 2.2%. Brand II was a striking 7.5% overweight, while Brands IV and V had net product overweights of 2.3 and 1.3, respectively. Considering all low-fat flavored yogurts surveyed, results showed a range from 1.5% under

TABLE 4. *Net weight of various brands of flavored low-fat commercial yogurts.*[a]

Product category	Net weight[b] (g)
Brand I	231.9 ± 3.69
Brand II	244.0 ± 5.15
Brand IV	232.6 ± 2.63
Brand V	229.9 ± 5.83
All samples (N = 28)	237.8 ± 7.78

[a]Mean ± standard deviation.
[b]Declared weight = 227.0 g.

declared container net weight to as high as 12.6% over declared container net weight. In summarizing the data for full-fat yogurts (not shown), Brand IV on the average was 4.7% greater than its declared container net weight, while Brand III averaged only 0.4% overweight. In general, it appears from these data that yogurt consumers are getting more than they are paying for.

Caloric content of yogurt

Table 5 shows estimates of caloric content, cal/100 g, of various commercial yogurts. These values are based on the caloric equation used by Kroger and Weaver (*7*). The mean caloric values for flavored low-fat and full-fat yogurts were 106 and 121 cal/100 g, respectively. Mean values for plain yogurt ranged from 69 cal for low-fat plain to 92 cal/100 g for full-fat plain. From these data it is apparent that low-fat plain yogurt contains 25% less calories than full-fat plain yogurt. Furthermore, it is evident that in relation to low-fat plain yogurt, full-fat and flavored yogurts account for a much increased caloric density on a per container basis. Flavoring addition alone accounted for approximately 30 cal/100 g for both the full and low-fat samples surveyed. Also of interest are the caloric ranges found in flavored yogurts. Low-fat flavored yogurt ranged from 80-120 cal/100 g while full-fat flavored samples ranged from 102-135 cal/100 g. Considering the wide variation in caloric content of market yogurts along with an overfill of almost 5% for all flavored samples surveyed, the caloric content of many yogurts may be substantially greater than the value indicated on the container.

TABLE 5. *Calculated caloric content of various commercial yogurts.*[a]

Product category	Calories/100 g
Flavored:	
Low fat (N = 28)	106 ± 9
Full fat (N = 13)	121 ± 10
Plain:	
Low fat (N = 3)	69 ± 4
Full fat (N = 2)	92 ± 20

[a]Mean ± standard deviation.

The data presented indicate that there is still much variation in yogurt composition not only between brands but within the same brand. Moreover, the results of the analyses obtained in this survey are in general agreement with those reported in the literature (*5,6,7*) in that wide variations were observed in gross composition. Apparently there has been little effort to standardize yogurt during the past 7 years despite the fact that better uniformity in composition and quality would be beneficial to both consumer and producer.

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