DETERMINATION OF THE REASONABLE OR PERMISSIBLE MARGIN OF ERROR IN DISPENSING. II. OINTMENTS.

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VARIATION IN CAPACITY OF OINTMENT JARS PURCHASED FROM MANUFACTURERS.

A second series of tests was carried out to determine to what extent jars of the same brand vary in capacity. With this object in view, jars labeled 1/2-ounce, 1-ounce and 2-ounce were purchased from four of the leading manufacturers of ointment containers, and these were subjected to the same tests in each case.

To obtain the desired data, ten jars were selected at random out of each box of twelve 1/2-, 1- and 2-ounce jars. Each of these jars was filled by 10 different students to obtain a fair average for the capacity of the jar. Petrolatum was selected as the base for filling, as it is the lightest of any of the four bases used in the tests, and also because it is the easiest to handle. It was poured in the melted condition between 43° and 45° C. to insure the absence of air-pockets which are always formed when the base is packed in the solid condition. The excess was removed by running the edge of a spatula over the top of the jar and wiping off any material adhering to the sides. The jars were not weighed until cool.

Each of the four manufacturers whose jars were used in these tests was requested to state what standard was used in determining capacity. Three replies were received. Manufacturer B stated that his standard for capacity was based on the apothecaries liquid measure of 480 minims to the fluidounce. It is assumed that the 480 minims refer to distilled water the equivalent of which is 454.6 grains by weight at 25° C. Manufacturer C stated that he arrived at his standard for capacity by using the apothecary ounce of 480 grains of petrolatum. It is stated further that "a one-ounce rated container will have a fluid capacity of 1.25 ounces" in terms of this standard. Manufacturer D stated his standard for capacity was based on the apothecaries ounce of 480 grains of petrolatum.

The results of the second series of tests are presented in Table VIII which follows on page 422.

The greatest variation in capacity of the 1/2-ounce jars of any one make was observed in those obtained from Manufacturer D. Jars 3 and 8 of this manufacturer showed a difference of 19 grains, and the S. D. was 6.55 grains for the ten jars. The next greatest variation in capacity was found in the jars obtained from Manufacturer C. Jars 7 and 10 of this manufacturer showed a difference of 15 grains, and the S. D. was 4.79 grains for the ten jars.

In the case of the one-ounce jars, the greatest variation in capacity was observed in those obtained from Manufacturer A. Jars 2 and 3 of this manufacturer showed a difference of 19.6 grains, and the S. D. was 5.96 grains for the ten jars.

In the case of the two-ounce jars, the greatest variation in capacity was found in those obtained from Manufacturer B. Jars 2 and 5 of this manufacturer showed a difference of 30.4 grains, and the S. D. was 10.25 grains for the ten jars.

It is an accepted fact that glass containers cannot be made of exactly the same capacity no matter what method of manufacture is followed or how carefully the work is done. The limits observed for variations in capacity, however, were surprisingly narrow, being less than 2 per cent for jars made by any one of the different manufacturers, except in the case of the half-ounce jars made by Manufacturer D.

TABLE VIII.—CAPACITY OF OINTMENT JARS PURCHASED FROM MANUFACTURERS.

Manufacturer.	Stated Capacity of Jar.	Average Capacity Found for Petrolatum U. S. P. in Grams.	Average Capacity in Grains Found by 10 Students. Jar 1.	Jar 2.	Jar 3.	Jar 4.	Jar 5.	Jar 6.	Jar 7.	Jar 8.	Jar 9.	Jar 10.	S. D. in Grains.	Percentage Deviation.
A	½-ounce	201.4	196.7	204.2	206.5	197.5	198.7	205.7	195.4	202.8	204.8	201.9	3.82	1.89
B	½-ounce	199.2	204.2	197.3	201.6	195.7	201.6	196.7	197.4	195.8	204.6	196.8	3.31	1.66
C	½-ounce	258.6	260.2	252.8	260.4	257.0	255.7	266.0	267.4	258.1	255.4	252.5	4.79	1.85
D	½-ounce	240.8	241.4	249.9	250.3	233.8	243.4	248.3	239.2	231.0	235.9	236.2	6.55	2.72
A	1-ounce	408.6	404.9	398.1	417.7	408.3	411.8	408.4	399.2	412.4	414.4	410.5	5.96	1.45
B	1-ounce	423.7	425.6	427.6	424.3	419.4	426.3	424.7	429.1	418.5	424.2	417.4	3.76	0.88
C	1-ounce	447.3	445.5	445.7	448.0	445.9	447.5	445.7	453.5	441.9	453.5	445.5	3.39	0.76
D	1-ounce	478.6	480.2	478.2	482.4	477.2	477.9	477.8	478.7	479.5	477.0	476.7	1.64	0.34
A	2-ounce	805.2	801.7	813.3	794.1	806.3	795.8	809.5	805.8	800.8	812.7	811.7	6.53	0.82
B	2-ounce	748.7	753.7	761.6	757.1	741.7	731.2	731.2	758.9	748.0	753.6	749.5	10.25	1.37
C	2-ounce	937.7	937.6	933.9	942.5	946.7	925.7	932.1	936.9	953.8	928.9	939.1	8.26	0.88
D	2-ounce	982.5	981.0	982.5	989.6	987.2	990.7	979.7	980.3	980.8	983.9	969.5	5.73	0.58

TABLE IX.—CAPACITY OF OINTMENT JARS PURCHASED IN RETAIL PHARMACIES.

Stated Capacity of Jar.	Average Capacity in Grains of Petrolatum Found by 3 Students for Store Number. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Av. Capacity in Grains for the 10 Stores.	S. D. in Grains.	Percentage Deviation.
½-ounce	253	259	241	246	246	224	199	203	212	229	231.2	20.09	8.68
1-ounce	445	446	533	480	459	483	418	410	494	525	469.3	39.31	8.38
2-ounce	947	929	960	810	961	968	799	811	810	841	883.6	70.78	8.01

TABLE X.—PERCENTAGE DEVIATION BASED ON AN OUNCE OF 480 GRAINS OF PETROLATUM.

Stated Capacity of Jar.	Total Number Stores.	Percentage Deviation from 480 Grains. 5% or Less.	From 5% Plus to 10%.	From 10% Plus to 15%.	From 15% Plus to 20%.
½-ounce	10	40%	30%	10%	20%
1-ounce	10	40%	30%	30%	..
2-ounce	10	50%	10%	10%	30%

If, however, jars made by different manufacturers are compared, the variation is so great that reasonable limits are exceeded in most cases. For instance, if a comparison is made between jar 7 of Manufacturer A and jar 7 of Manufacturer C, a difference of 72 grains will be observed for the so-called $^1/_2$-ounce jar. In the case of the one-ounce jars, there was found to be a difference in capacity of 84.3 grains between jar 2 of Manufacturer A and jar 3 of Manufacturer D. With respect to the two-ounce jars, there was found to be a difference in capacity of 259.5 grains between jar 5 of Manufacturer B and jar 5 of Manufacturer D. The exceedingly wide variation observed for the capacities of these jars is no doubt due mainly to the difference in the standards used by the manufacturers for determining capacity as already pointed out. The remedy for this condition is the adoption of a uniform set of standards for use by all manufacturers.

VARIATION IN CAPACITY OF OINTMENT JARS PURCHASED FROM RETAIL PHARMACIES.

A third series of tests was carried out to determine to what extent ointment jars used in retail pharmacies in the City of Baltimore varied in capacity. With this object in view $^1/_2$-ounce, 1-ounce and 2-ounce jars were purchased from two professional pharmacies, two downtown independent pharmacies, three chain stores and three neighborhood pharmacies, and these were tested for capacity as described under the second series of tests, except that the ten jars of each size were each filled by three different students to obtain a fair average for the capacity of the jar instead of ten students as in the preceding tests. Petrolatum was used as the base for filling. It was poured in the melted condition between 43° and 45° C. so as to eliminate any air-pockets that might be formed in packing the solid base. The excess was removed by running the edge of a spatula over the top of the jar and wiping off any material adhering to the sides. The jars were not weighed until cool.

The results of the third series of tests are presented in Table IX, page 422.

On comparing the results of the three series of tests, it will be observed that the standard deviation for the $^1/_2$-, 1- and 2-ounce jars is much higher than that of Series one and two. In Series two, jars purchased from manufacturers, and in Series three, jars purchased from retail pharmacies, the standard deviation found for the $^1/_2$-ounce drug store jars was about three times that of the greatest deviation observed for jars obtained directly from the manufacturer. The standard deviations in the case of the one- and two-ounce jars are about 7 times as great as those of the highest standard deviation observed in the second series of tests.

The greatest difference in capacity of any of the one-half-ounce ointment jars purchased from drug stores was 60 grains, for the one-ounce jars 123 grains, for the two-ounce jars, 169 grains.

For the purpose of making it possible to more readily compare these results with similar data that have been published, but which have not been expressed in terms of the standard deviation, the per cent of deviation from the theoretical, 480 grains to the ounce, has been calculated and is given in Table X, page 422. It will be observed that the margin of error calculated on this basis is 15 per cent for the one-ounce jars and 20 per cent for the one-half and two-ounce jars obtained from the ten stores in Baltimore.

CONCLUSIONS.

1. Petrolatum was the lightest of the four bases studied, followed in order by a 50 per cent lanolin and petrolatum mixture, lanolin and benzoinated lard when packed as received.

2. The frequency and magnitude of error are greater in cases where the base is packed in the solid state, than in those where the filling is accomplished by melting and pouring, except for benzoinated lard.

3. The capacity of jars by weight is decreased by triturating the ointment base on a slab previous to packing in the solid state.

4. The capacity of jars by weight may be decreased or increased by the incorporation of a liquid or a solid with the base, depending on the nature of the liquid or solid and other factors.

5. The percentage of error found was in inverse proportion to the size of the jar.

6. Jars of a designated size made by a single manufacturer do not vary in capacity beyond reasonable limits. There was observed, however, a great variation in the capacity of jars of a designated size made by different manufacturers. The latter variation is due largely to the use of different standards by the manufacturers for fixing capacity. To overcome this condition it is suggested that uniform standards for fixing standards be adopted by the manufacturers, and that the material taken as the basis for formulating these standards be petrolatum, because of its comparatively low specific gravity and uniformity with respect to other physical properties.

7. The results of the tests show that it is impossible for a glass manufacturer to prepare ointment jars which will hold the same quantities by weight of the different ointments dispensed on physicians' prescriptions. It is believed, however, that it is possible for them to manufacture ointment jars which will hold within reasonable limits definite quantities of petrolatum or other base selected as a standard. The pharmacist will then be able to dispense the full quantity of an ointment with a low specific gravity. In the case of ointments with a high specific gravity, the filling of the jar may be done in such a manner as to leave a concave surface, thereby preventing the ointment from coming in contact with the top of the jar, and also satisfying the patient as to the fullness of the jar. In the case of very heavy ointments, such as mercurial ointments, it will be necessary to weigh off the quantity prescribed and to dispense it in a jar of the size which it will come nearest to filling.

8. With regard to the margin of error which may reasonably be expected in dispensing where jars of the same manufacture are used, our observations point to a figure which at the outside is twice the standard deviation, or 25 per cent, for $^1/_2$- and 1-ounce jars; and twice the standard deviation, or 18 per cent, for 2-ounce jars.

(*To be continued.*)

"A Note on the Arsenic Determination for Reduced Iron," by Margarethe Oakley and John C. Krantz, Jr.—Abstract of Paper, Scientific Section, A. PH. A.

A simplified method of treatment for the preparation of ferrous arsenide in reduced iron for the modified Gutzeit test has been devised.