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Vitamin A Potency of Market Milk

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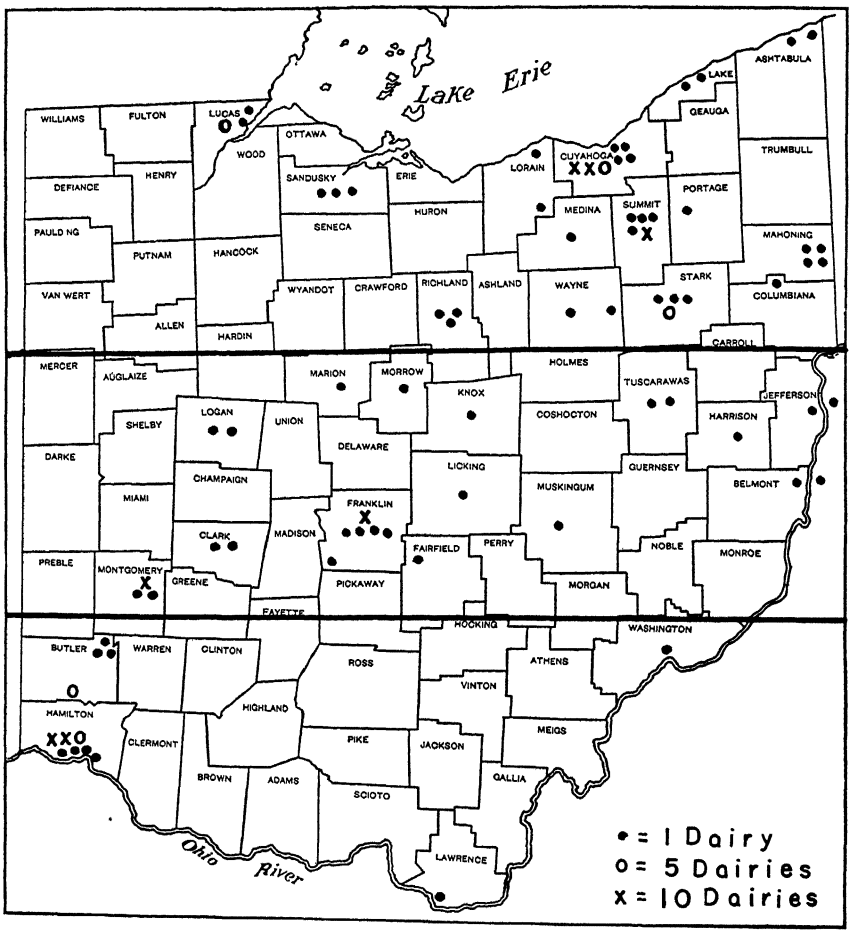

Fig. 1.—Location of 162 dairies from which the Ohio market milk samples were obtained. Northern section of the state—79 dairies; Central section—44 dairies; and Southern section—39 dairies.

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Introduction

In a previous report (14) the vitamin A potency of butter produced in Ohio in various areas and at different seasons was presented as a part of a nationwide cooperative survey. The results were published as a whole (24) and by some of the participating states (1, 2, 4, 5, 6, 7, 8, 12, 15, 19, 21, 22, and 23).

Numerous reports have appeared in the literature regarding the factors affecting the vitamin A content of milk and butterfat (9, 10, 11, 13, 16, 17, 18, and 20). The importance of fluid milk in the human diet of this country as a means of meeting vitamin A requirements suggested the need for more information regarding the vitamin A potency of market milk in various areas and at different seasons of the year. The following survey of the vitamin A potency of market milk was conducted in order to gather such information on milk produced in Ohio.

Experimental

During a two-year period samples of vitamin D-fortified milk from 162 dairies scattered over the state were sent to the Ohio Agricultural Experiment Station for vitamin D assay. These samples were received in the original bottles in iced containers within 24 to 72 hours after being produced and were sampled for vitamin A and carotene[1] determinations immediately after arrival. The results of these determinations constitute the basis for this report.

The location of the 162 dairies in Ohio from which 712 samples of milk were obtained in a two-year period is shown in Figure 1.

Essentially the same method described by Boyer, et al (3) was used to determine the content of vitamin A and carotene except that a 10-minute hot saponification was used instead of the cold saponification. Final colorimetric readings were made with an Evelyn photoelectric

[1]Crude carotenoids, not pure beta carotene.

colorimeter. The following formula was employed to convert micrograms of vitamin A and carotene to U. S. P. units of vitamin A potency.

$$\frac{\text{Carotene (micrograms/quart)}}{.6} \text{ plus Vitamin A (microgram/quart} \times 4)$$

Results

The vitamin A potency of Ohio market milk during the two test years is plotted in U. S. P. units per liter (Fig. 2).

Table 1 indicates the number of samples received each month, plus the carotene, vitamin A, and the U. S. P. units of vitamin A activity per

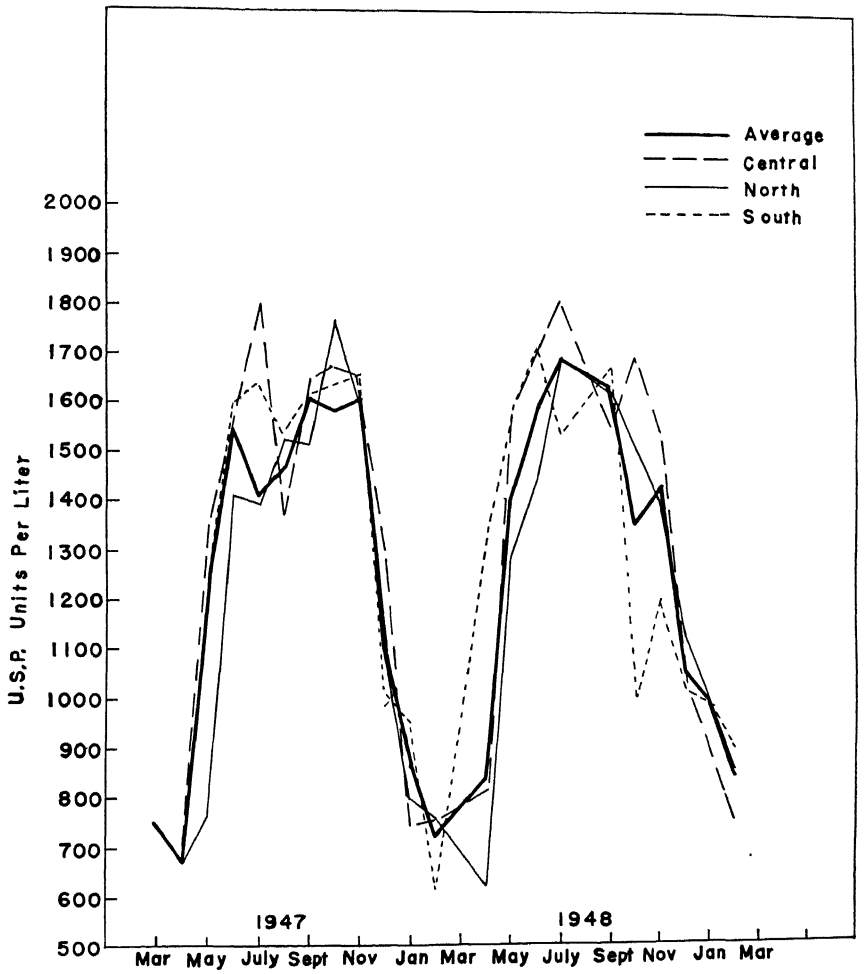

Fig. 2.—Seasonal and regional variation of the vitamin A potency of Ohio market milk.

quart of milk. Examination of Table 1 shows that during each of the two years the variations in the average carotene, vitamin A, and the U. S. P. units of vitamin A are quite similar.

TABLE 1.—Vitamin A Potency of Ohio Market Milk

	No. samples	Carotene micro-grams/quart	Vitamin A micro-grams/quart	U. S. P. units per quart
1947				
March	5	95	139	718
April	29	102	117	640
May	38	270	177	1157
June	20	386	205	1465
July	32	343	192	1339
August	32	321	214	1390
September	34	339	238	1518
October	17	321	241	1500
November	47	370	225	1518
December	44	265	156	1066
1948				
January	30	180	132	826
February	39	113	124	683
Average	367	259	180	1152
1948				
March	0			
April	73	169	130	802
May	74	335	192	1326
June	10	354	226	1494
July	12	366	246	1594
August	0			
September	29	361	234	1538
October	28	310	191	1281
November	46	345	194	1351
December	40	233	155	1008
1949				
January	11	185	159	944
February	22	154	135	797
Average	345	281	186	1214

The period of lowest vitamin A potency was during the winter barn feeding period, approximately from November until May. From May until November a relatively high level existed. This period coincides roughly with the pasture season.

Differences in vitamin A potency by regions (Northern, Central, and Southern) were not significant (Table 2) although there was some indication that, on the average, market milk in the Central and Southern parts of the state had slightly higher vitamin A activity. On a seasonal basis it was apparent in the Southern region that vitamin A activity increased markedly in April, which is a reflection of earlier pasturing. It is also apparent that the fall pasture season of 1948 was more favorable

TABLE 2.—Vitamin A Potency of Ohio Market Milk from Different Regions

Year / Months	No. samples			Carotene micrograms/quart			Vitamin A micrograms/quart			U. S. P. units per quart		
	North	Central	South	North	Central	South	North	Central	South	North	Central	South
1947												
March	5	0	0	97	...	...	139	...	...	718	....	....
April	16	13	0	99	106	..	118	117	...	637	645	....
May	4	10	24	132	308	277	129	188	182	736	1265	1190
June	4	6	10	285	412	412	216	198	205	1339	1479	1507
July	30	1	1	332	566	440	192	189	206	1321	1699	1557
August	19	11	2	328	308	322	224	192	230	1443	1281	1457
September	4	5	25	308	379	336	230	231	242	1433	1556	1528
October	4	8	5	362	391	367	267	233	233	1671	1584	1544
November	33	6	8	366	402	361	221	226	241	1494	1574	1566
December	20	11	13	246	356	218	157	160	150	1038	1233	963
1948												
January	6	8	16	142	162	199	131	110	144	761	710	908
February	22	6	11	119	116	98	132	131	106	726	717	587
Average										1110	1249	1281
1948				235	319	303	180	180	194			
March	0	0	0	...	...	...	...	...	...	...	....	....
April	38	16	19	100	155	319	107	128	178	595	770	1244
May	43	14	17	296	402	376	180	207	213	1213	1498	1479
June	5	0	5	280		428	224		227	1363	....	1621
July	4	1	7	393	483	334	238	434	223	1607	2541	1449
August	0	0	0	..	..	..	...	...	...	...	....	....
September	7	8	14	338	376	365	242	210	243	1531	1467	1580
October	10	7	11	337	428	211	216	224	148	1426	1609	944
November	33	12	1	324	416	221	196	190	191	1324	1453	1132
December	14	6	20	265	221	214	157	161	152	1070	1012	965
1949												
January	8	0	3	185	...	186	160	.	156	948	....	934
February	14	4	4	146	164	175	138	113	142	795	725	860
Average				266	331	283	186	208	187	1187	1384	1220

than in 1947 since the vitamin A potency of milk produced during October, November and December of 1948 definitely was higher.

Discussion

The results obtained in this study give a reasonably accurate evaluation of the variations in vitamin A potency of Ohio market milk produced in different areas and at different seasons of the year. The pattern of variation follows closely that obtained in the butter study (14), although many more samples are involved.

The variations in different locations in the same month probably are due to differences in feeding practices, weather conditions, and predominating breed of cattle.

The low values obtained in the winter months emphasize the importance of high quality roughage programs that could materially increase the vitamin A level of winter milk. Winter pasture should not be overlooked in such programs. The recent work of Monroe et al (18) concerning the effect of winter rye pasture on the vitamin A potency of milk is of particular interest in this connection.

Although the level of vitamin A in milk is relatively high during the pasture season, anything that can be done to assure better pastures throughout the season will tend to raise it to an even higher peak.

Summary

Seven hundred and twelve samples of market milk from 162 dairies in Ohio were analyzed for vitamin A and carotene during a two-year period.

The average vitamin A potency of Ohio market milk was found to be 1152 and 1214 U. S. P. units per quart in 1947 and 1948, respectively, and ranged from a low of 640 U. S. P. units per quart in April, 1947 to 1594 U. S. P. units per quart in July, 1948.

A higher average level was found in the Southern part of the state, which is believed to be caused by the somewhat longer pasture season.

The need for higher quality roughages and pastures is emphasized as a means of raising the average level of vitamin A potency in Ohio market milk.

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