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NUTRITIONAL STATUS OF RURAL YOUTH

V. Malheur County

by

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This report on the nutritional status of rural youth in Malheur county is the last in a series of five progress reports on a project being conducted by the Oregon Agricultural Experiment Station in cooperation with the School of Home Economics of Oregon State College and the General Research Council of the Oregon State Board of Higher Education. Other reports on the nutritional status of rural youth in Marion, Josephine, Tillamook and Sherman counties have already appeared.

Procedure and Results

Measurements were made in Malheur county during September and October, 1943 and April, 1944. Nine schools were chosen and about 10% of the children in each school participated in the tests. Blood samples were taken on two non-consecutive mornings, and hemoglobin and plasma vitamin C levels were determined. Each child kept a record of everything he ate for the period of one week.

Hemoglobin

Hemoglobin values were determined for 37 grade school children and 26 high school students ranging in age from 9 to 18 years. In general, according to present standards, these healthy Malheur county young people were not anemic, as only one had a value below 12.35 gms. per 100 ml. of blood.

As seen in Table 1, the hemoglobin of boys 9 to 13 years of age averaged 13.92 grams per 100 ml. of blood, while that of girls of the same age averaged 13.84 grams. These values are higher than the average of 12 grams per 100 ml. of blood reported by Osgood and Baker in a study of 215 Portland, Oregon children 4 to 13 years of age.

Fourteen to 15 year old boys showed an average of 14.96 grams of hemoglobin per 100 ml. of blood, while the one 16 year old subject had a hemoglobin value of 15.73 grams. This latter value is close to the average of 15.80 grams found by Dr. Osgood for males over 14. Girls 14 to 15 years of age had an average of 14.01 grams and those 16 to 18 years an average of 14.50 grams per 100 ml. blood. These figures are above the average of 13.80 grams of hemoglobin per 100 ml. of blood found by Osgood in females over 14.

Table 1. Hemoglobin values for age and sex

Age and sex	No. subjects	Grams of hemoglobin per 100 ml. of blood	
		Average	Range
9 to 13 years			
Boys	19	13.92	11.86 to 16.21
Girls	17	13.80	12.35 to 15.49
14 to 15 years			
Boys	11	14.96	13.38 to 16.42
Girls	9	14.01	12.42 to 15.04
16 to 18 years			
Boys	1	15.73	— —
Girls	6	14.50	14.14 to 15.04

Plasma Vitamin C

The blood plasma vitamin C level depends on the daily intake of vitamin C. The committee on Vitamins of the American Academy of Pediatrics (1940) has considered a level of 0.60 mg. of ascorbic acid (vitamin C) per 100 ml. of plasma as an adequate level. However, for optimal nutrition, the level should be 0.80 mg. or above.

Plasma ascorbic acid values were obtained for 26 grade school children and 6 high school students in the fall and 5 grade school and 16 high school students in the spring. The averages for the grade school subjects in the fall and spring were 0.71 mg. and 0.35 mg. ascorbic acid per 100 ml. plasma respectively. The averages for the high school subjects for fall and spring were 0.73 mg. and 0.35 mg. respectively. All but two subjects in the spring showed plasma ascorbic acid values below 0.60 mg. per 100 ml.

Table 2. Comparison of Average Plasma Ascorbic Acid (Vitamin C) Values of Grade and High School Children Expressed as mg. of Ascorbic Acid per 100 ml. of Plasma

	No. Subjects	Fall		Spring		
		Number with values below 0.60 mg.	Average plasma ascorbic acid	No. Subjects	Number with values below 0.60 mg.	Average
Grade school	26	8	0.71	5	5	0.35
High school	6	2	0.73	16	14	0.35

The difference between the fall and spring values was of high statistical significance. The differences among values for different age groups were not significant statistically, nor were the differences between values for sexes within age groups during the same season.

Table 3. Fall and Spring Plasma Ascorbic Acid (Vitamin C) Levels of Boys and Girls at Different Ages
Ascorbic Acid Expressed as mg. per 100 ml. of Plasma

	10 to 11		12 to 13		14 to 15		16 to 17	
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
Fall								
Boys	6	0.79	7	0.74	1	0.72	1	0.54
Girls	8	0.77	5	0.68	4	0.56	0	-
Total	14	0.78	12	0.72	5	0.61	1	0.54
Spring								
Boys	1	0.49	2	0.54	8	0.30	0	-
Girls	2	0.34	1	0.03	2	0.36	5	0.42
Total	3	0.39	3	0.37	10	0.30	5	0.42
Total (Fall and Spring)								
Boys	7	0.75	9	0.70	9	0.39	1	0.54
Girls	10	0.68	6	0.58	6	0.51	5	0.42
Total	17	0.70	15	0.65	12	0.43	6	0.44

Only one sample of blood was obtained from a group of 21 high school students in the fall, as the schools closed for the beet harvest before the second sample could be secured. These plasma ascorbic acid values were not included in the fall group. Sixteen of these students, though, were tested in the spring, at which time two blood samples were taken. A comparison of the averages of the two spring samples with the single fall sample showed that 66% of the boys and 62% of the girls had dropped in plasma ascorbic acid values. The average drop was 0.12 mg. of ascorbic acid per 100 ml. of plasma for the boys and 0.27 mg. for the girls. Of six grade school children tested in both the fall and spring (only 2 had had two blood samples taken during both seasons), all showed a lowering in plasma ascorbic acid value. The average drop was 0.23 mg. of ascorbic acid per 100 ml. of plasma.

Food Consumption Records

The most outstanding difference between the fall and spring food records was found in the consumption of raw fruits other than citrus fruits. The higher average for plasma ascorbic acid levels found in the fall can be directly correlated with the consumption of these raw fruits (Tables 4 and 5). The fall food records showed an average consumption of 7.2 servings per week; the spring, an average of only 0.3 servings per week. Peaches, melons, and apples were the most commonly used raw fruits.

The consumption of citrus fruits and tomatoes was slightly higher in the spring than in the fall, averaging 7 servings a week in the spring as against 5.3 serving in the fall, but considerably more tomatoes were eaten in the fall and more citrus fruits in the spring. The consumption of raw vegetables showed an average of 2.4 servings per week in the fall as against 1.4 servings per week in the spring.

Table 4. Relationship of the Number of Servings of Fruits and Vegetables and the Plasma Ascorbic Acid Values in Different Age Groups

Age and season	Mg. of ascorbic acid per 100 ml. of plasma	Citrus fruits and tomatoes	Other raw fruits and vegetables	Total citrus fruits and tomatoes and other raw	Other fruits and vegetables
Fall					
10 to 11	0.78	6.16	12.11	18.27	11.90
12 to 13	0.72	5.04	12.74	17.78	12.04
14 to 15	0.61	7.91	6.37	14.28	14.98
16 to 17	0.54	5.95	2.94	8.89	22.96
Spring					
10 to 11	0.39	5.46	2.73	8.19	13.86
12 to 13	0.37	5.60	2.66	8.26	18.27
14 to 15	0.30	8.05	2.24	10.29	17.64
16 to 17	0.42	5.88	0.98	6.86	18.69

The varieties of vegetables used extensively were not great: corn, green beans, peas, carrots, lettuce and cabbage appeared most often. Green leafy vegetables other than cabbage and lettuce were seldom used (Table 6a and 6b). Cooked and canned vegetables were served on the average of 4.4 times a week in the fall and 7.2 times in the spring.

Milk consumption dropped from an average of 15.5 glasses per week in the fall to an average of 13.6 glasses, including milk used on cereal and milk drinks such as cocoa in the spring but not including milk used in cooking. Cheese consumption was slightly higher in the spring—1.9 servings per week as against 0.6 servings per week in the fall.

The large number of eggs eaten in the spring was probably indicative of the greater abundance during that period of the year. Meat, fish and poultry consumption was also slightly higher in the spring — averaging 9.5 servings per week as compared with 7.7 servings per week in the fall.

Table 5. Consumption of milk, eggs, meat, fruits and vegetables

Food	Average number of servings per week	
	Fall 1943	Spring 1944
Milk and cream	15.5	13.6
Cheese	0.6	1.9
Eggs	3.4	6.2
Meat, fish and poultry	7.7	9.5
Citrus fruits and tomatoes	5.3	7.0
Raw vegetables	2.4	1.4
lettuce	0.7	0.7
cabbage	0.4	0.4
carrots	0.4	0.5
celery	0.1	0.1
mixed raw salads and other	0.8	0.2
Raw fruits other than citrus	7.2	0.3
apples	1.0	0.2
others	6.2	0.1
Potatoes	6.7	6.6
Cooked and canned vegetables	4.4	7.2
Dry peas and beans	0.9	0.9
Cooked, canned and dried fruits	3.3	3.9

Table 6a. Number of servings of fruits and vegetables in the fall

Records of 360 days by 48 children

Food	No. Servings	Food	No. Servings
Citrus fruits - total	47	Dry peas and beans - total	49
oranges	44	navy	37
grapefruit	3	red	10
Tomatoes - total	281	lima	1
tomatoes	271	garbonzas	1
tomato soup	10	Raw fruits - total	372
Potato	342	peaches	147
Raw vegetables - total	121	apples	50
lettuce	36	watermelon	44
cabbage	22	cantaloupe	42
carrots	21	grapes	41
celery	3	pears	18
other	39	bananas	12
Cooked vegetables - total	215	plums	11
corn	45	strawberries	3
green beans	33	Cooked, canned and dried	
vegetable soup	27	fruits - total	150
peas	24	peaches	41
carrots	19	apples	27
beets	14	mixed fruit	21
vegetable salad	14	apricots	15
squash	9	prunes and plums	14
cabbage	7	pears	8
egg plant	5	cherries	7
cauliflower	5	raisins	2
peas and carrots	2	pumpkin pie	2
sweet potato	2	gooseberries	1
greens	2		
sauerkraut	2		
parsnips	2		
broccoli	1		
green pepper	1		

Table 6b. Number of servings of fruits and vegetables in the spring

Records of 199 days by 29 children

Food	No. Servings	Food	No. Servings
Citrus fruits - total		148	
oranges	117	Dry peas and beans - total	26
grapefruit	26	navy	13
lemons	5	red	9
Tomatoes - total		peas	3
tomatoes	51	lima	1
tomato soup	6	Raw fruits - total	7
Potatoes		apples	6
Raw vegetables - total		raspberries (frozen)	1
lettuce	21	55	
carrots	14	Cooked, canned or	
cabbage	11	dried fruits - total	113
celery	2	peaches	30
other	7	mixed fruit	12
Cooked vegetables - total		prunes and plums	12
peas	47	cherries	11
corn	44	pears	10
vegetable soup	27	raisins	9
carrots	22	pineapple	9
green beans	19	berries	7
asparagus	9	apricots	7
spinach	6	apples	4
beets	5	avocado	1
vegetable salad	3	rhubarb	1
peas and carrots	3		
onions	2		
cauliflower	2		
greens	2		
parsnips	2		
sweet potato	1		
sauerkraut	1		
turnips	1		
mixed	1		
succotash	1		

Summary

1. In general, according to present standards, these Malheur County young people would not be considered anemic, as the lowest value found was 12.35 gm. per 100 ml. of blood.
2. In the fall, the plasma ascorbic acid values of 31% of the subjects fell below 0.60 mg. per 100 ml., while in the spring 90% of the values were below this level.
3. The difference between average fall and spring values of plasma ascorbic acid was of high statistical significance. The average level for grade and high school subjects in the fall was 0.71 mg. and 0.73 mg. of ascorbic acid per 100 ml. of plasma respectively; the average in the spring for both grade and high school subjects was 0.35 mg. No difference was observed between sexes.
4. The much higher average for ascorbic acid levels in the fall can be directly correlated with the high consumption of melons, peaches and other raw fruits other than citrus fruits. The fall records showed an average consumption of 7.2 servings per week as against 0.3 servings per week in the spring. The consumption of citrus fruits and tomatoes showed no great seasonal variation in total, being only slightly higher in the spring than in the fall, but considerably more tomatoes were consumed in the fall, and more citrus fruits in the spring.
5. Neither the variety of vegetables used nor the numbers of servings was great. Green leafy vegetables other than cabbage and lettuce were seldom used.
6. Milk consumption as fluid milk or milk drinks dropped from an average of 15.5 glasses per week in the fall to an average of 13.6 glasses in the spring.
7. Meat, fish and poultry and egg consumption averaged slightly higher in the spring than in the fall. The average number of eggs consumed per week in the fall was 3.4, while in the spring the average was 6.2. Meat, fish and poultry were served on the average 7.7 times per week in the fall and 9.5 times per week in the spring.