

Suggested Guidelines for Evaluation of the Nutritional Status of Preschool Children



REVISED 1967

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**SUGGESTED GUIDELINES FOR EVALUATION OF THE
NUTRITIONAL STATUS OF PRESCHOOL CHILDREN**

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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REVISED 1967

SUGGESTED GUIDELINES FOR EVALUATION OF THE NUTRITIONAL STATUS OF PRESCHOOL CHILDREN

To draw up a set of guidelines for evaluating the nutritional status of preschool children, a group of experts under the sponsorship of the Children's Bureau met in Washington, D.C. in January 1966 with representatives of the Department of Health, Education, and Welfare, the Department of Agriculture, and the Office of Economic Opportunity.

The guidelines agreed upon at this meeting make up this publication.

It is hoped that these guidelines will stimulate physicians and others concerned with the health of preschool children to include an assessment of children's nutritional status as a part of their medical evaluation or appraisal.

Included in these guidelines are sections on social, economic, and educational status; personal information and health history; dietary intake; physical examination; biochemical measurement of blood and urine; and roentgenography.

Information related to nutritional status can be obtained in many ways during other parts of the health appraisal of preschool children. Not every individual interested in this area will be able to obtain all the information these guidelines can provide.

However, some information about nutritional status important to health personnel working with children aged 1 through 4 can be obtained by using these guidelines.

QUESTIONS TO PROVIDE INFORMATION ABOUT THE PRESCHOOL CHILD'S COMMUNITY

Certain general information relating to nutritional status will generally be available from local or State health authorities (e.g., the fluoride content of drinking water) or from wholesale and retail grocers (e.g., availability of iodized salt and vitamin D-fortified fluid milk) rather than from the children surveyed. This information will be useful in supplementing personal data and will, in some instances, help in interpreting this data. The questions which follow might be used to obtain such information.

Fluoride content of drinking water?

_____ ppm in community water supply

naturally fluoridated

artificially fluoridated

_____ ppm in well water

Iodized salt?

_____ percent of sales of salt

Indicate basis on which the above percentage is estimated:

survey of wholesale grocers

survey of retail grocers

others (please describe): _____

Vitamin D-fortified milk?

_____ percent of sales of fluid milk

Indicate basis on which the above percentage is estimated?

survey of wholesale grocers

survey of retail grocers

others (please describe): _____

QUESTIONS TO PROVIDE PERSONAL INFORMATION AND INFORMATION ABOUT THE CHILD'S HEALTH HISTORY

Certain items of personal information of a general nature are essential for interpreting data relating to nutritional status. For example, the season of the year (given here by "Date of Evaluation") will be of value in interpretation of the serum concentration of carotene. Motor development will ordinarily be retarded in the case of severe or prolonged illness ("serious illnesses") while the age at which the child began to walk ("walked at ____ months") represents a developmental landmark that will be recalled by most parents of preschool children. This landmark is useful in assessing progress during infancy. Immunization status ("Immunization") will in many cases reflect level of health supervision.

The most common manifestation of gross nutritional deficiency -- retarded growth -- may reflect serious illness of a non-nutritional origin. Proper interpretation is therefore impossible unless a record is made of each serious or prolonged illness. Keep such a record. This knowledge of past or current illnesses may also aid in interpreting other manifestations suggesting nutritional deficiency.

The questions that follow, or some modification of them, will provide much useful background information.

Date of Evaluation _____

Name _____

Address _____

Sex:

male

female

Birth date _____

Birth weight _____

Birth order _____

Born:

in hospital

at home

other (specify):

Immunization:

DPT primary series

DPT booster

Smallpox vaccine

Oral polio vaccine

Measles vaccine

Walked at _____ months

Was child breastfed?

not at all

less than 1 month

1-3 months

3-6 months

more than 6 months

Serious illnesses:

Hospitalizations (give age, time hospitalized, and nature of illness):

Ill now? If ill, indicate nature of illness:

QUESTIONS TO PROVIDE INFORMATION ABOUT THE CHILD'S FAMILY

Studies have indicated that the frequency of nutritional deficiency disorders are highly correlated with the economic status of the child's family and with the educational level of his parents -- especially his mother's. Also, the outcome of a mother's pregnancies may suggest that her health supervision has been poor or that her pre-school child may have received poor endowment of various nutrients at birth.

It is believed that the information produced by the following questions will be of considerable value in interpreting the data on the child's nutritional status.

The descriptive family entries on numbers, ages, income, and education provide basic data which will allow anyone to compare his results with family data collected by the U.S. Census Bureau.

Father		Mother
_____	Age (years)?	_____
<input type="checkbox"/>	White?	<input type="checkbox"/>
<input type="checkbox"/>	Negro?	<input type="checkbox"/>
<input type="checkbox"/>	Other non-white?	<input type="checkbox"/>
<input type="checkbox"/>	Usually lives with family?	<input type="checkbox"/>
<input type="checkbox"/>	Does not live with family?	<input type="checkbox"/>

Education?*(
Highest grade ever completed)

<input type="checkbox"/>	0	<input type="checkbox"/>
<input type="checkbox"/>	1-3	<input type="checkbox"/>
<input type="checkbox"/>	4-6	<input type="checkbox"/>
<input type="checkbox"/>	7-8	<input type="checkbox"/>
<input type="checkbox"/>	9-11	<input type="checkbox"/>
<input type="checkbox"/>	High school graduate	<input type="checkbox"/>
<input type="checkbox"/>	Attended college	<input type="checkbox"/>
<input type="checkbox"/>	Don't know	<input type="checkbox"/>

Home location?

urban suburban rural non-farm farm other

*If information is entered regarding another adult responsible for the child because the father or mother does not live with the child, enter here:

Yes

Other information about the child's mother:

Number of pregnancies?

Of liveborn infants, number

_____ liveborn

_____ now living

_____ stillborn

_____ now dead

_____ miscarriage

died less than 1 year _____

Age of mother?

died 1-5 years _____

_____ at term, 1st pregnancy

died more than 5 years _____

_____ when this child was born

_____ at term, most recently terminated pregnancy

Now pregnant

How many members in the household? _____

Number of family members living in the child's home, by age (include the child):

Age	0	1	2	3	4	5	6	7+
Under 6								
6-15								
16-21								
22-54								
55-64								
Over 64								

Family income (including public welfare and assistance help, about how much was the total family cash income to all members living at home last year):

Thousands of dollars (check one)

0	1	2	3	4	5	6	7	8	9	10	over 10

Hundreds of dollars (check one)

0	1	2	3	4	5	6	7	8	9

Check all sources of family income last year:

Retirement

- Social Security (including railroad retirement)
- Social Security Survivor Benefits
- Private and Government Retirement
- Armed Forces Retirement

Public Assistance

- To the blind and disabled
- To the aged
- To dependent children
- To disabled veterans
- Other aid

Other (including earnings)

Unemployment insurance

Wages, salary and net profit from own business

Interest, dividends, etc.

Other income

Is family:

Receiving donated foods

Participating in Food Stamp Program

THE PHYSICAL EXAMINATION

A complete physical examination is essential. Not only will it detect signs suggesting specific nutritional deficiencies, but it will also detect evidence of other diseases and abnormalities that may influence the interpretation of data. The items indicated on this physical examination form can be detected even though the physician has not had experience in evaluating the specific signs of nutritional deficiency disorders.

Weight and height are probably the most important measures of nutritional status, and should be accurately determined. Scales should be checked frequently with standards. Weight should be recorded to the nearest 0.2 kg. (or 0.5 lb.) with the child wearing light clothing or robe but no shoes.

Height is recorded as length (recumbent) for children less than two years of age and for those whose height (standing) cannot be adequately determined. Measurement of length to the nearest 0.5 cm (or $\frac{1}{4}$ inch) is made as described by Falkner (Pediat. Clin. N. America 8:13, 1961). The height of children two years of age and older should be recorded as standing when this is possible. Measurement of height should be made to the nearest 0.5 cm (or $\frac{1}{4}$ inch) without shoes using a right-angle triangular block of wood against a vertical wall.

The male-female, height and weight, data presented will permit use of standard statistical techniques (using American or English measurements) to evaluate height and weight of the children being surveyed. When mean or median height and/or weight at a specified age is less than that listed, and when this difference is statistically significant at the 95 percent level of confidence, a tentative interpretation of inadequate nutritional status is probably justified.

General

- pallor
- apathy
- irritability

Measurements

- weight _____ lb. or _____ kg.
- height _____ cm. or _____ inches
- length
- height

Gums

- swollen
- bleeding

Teeth

- number decayed _____
- or missing: _____

Thyroid

- visible enlargement

Other significant findings:

Skin

- petechiae
- dermatitis

Heart

- murmur
- probably innocent
- probably organic
- significance uncertain

Abdomen

- hepatomegaly
- splenomegaly
- distension

Lower extremities

- edema

Skeletal

- cranial bossing
- enlarged joints
- costochondral beading

WEIGHT OF MALES FROM ONE TO FIVE YEARS OF AGE

Age (year)	Number of Subjects	KILOGRAMS (percentiles)									
		3rd	5th	10th	25th	50th	75th	90th	95th	97th	
1	223*	(8.4)**	8.5	8.9 (8.9)	9.4 (9.5)	10.0 (10.1)	10.8 (10.8)	11.4 (11.5)	11.9	(12.4)	
1-1/2	218	(9.6)	9.7	10.0 (10.1)	10.6 (10.8)	11.4 (11.4)	12.3 (12.2)	13.0 (13.2)	13.4	(14.3)	
2	215	(10.6)	10.6	10.9 (11.2)	11.7 (11.9)	12.6 (12.6)	13.4 (13.5)	14.4 (14.5)	14.8	(15.8)	
2-1/2	200	(11.4)	11.5	11.9 (12.1)	12.5 (12.9)	13.7 (13.6)	14.7 (14.6)	15.7 (15.7)	16.0	(16.8)	
3	205	(12.3)	12.2	12.8 (13.0)	13.6 (13.7)	14.7 (14.6)	15.6 (15.7)	16.7 (16.7)	17.4	(17.8)	
3-1/2	195	(12.9)	13.2	13.8 (13.8)	14.6 (14.7)	15.7 (15.6)	16.9 (16.7)	17.9 (17.7)	18.2	(18.8)	
4	195	(13.7)	13.9	14.6 (14.6)	15.3 (15.4)	16.7 (16.5)	18.0 (17.7)	19.2 (18.8)	19.7	(20.1)	
4-1/2	185	(14.3)	14.7	15.3 (15.3)	16.3 (16.2)	17.8 (17.4)	18.8 (18.8)	20.3 (19.9)	21.1	(21.5)	
5	181	(15.2)	15.3	16.1 (16.1)	17.3 (17.0)	18.8 (18.4)	20.1 (20.0)	21.5 (21.2)	22.3	(22.9)	

*Data from Fels Institute kindly supplied by Dr. S.M. Garn and Mrs. Christabel G. Rohmann.

**Values in parentheses are taken from studies of Child Health and Development, Department of Maternal and Child Health, Harvard School of Public Health (in Nelson, W.E. (e.d.): Textbook of Pediatrics, Philadelphia, W.B. Saunders Co., 8th ed., 1964.

WEIGHT OF MALES FROM ONE TO FIVE YEARS OF AGE

Age (year)	Number of Subjects	POUNDS (percentiles)								
		3rd	5th	10th	25th	50th	75th	90th	95th	97th
1	223	(18.5)	18.7	19.7 (19.6)	20.9 (20.9)	22.0 (22.2)	23.8 (23.8)	25.1 (25.4)	26.2	(27.3)
1-1/2	218	(21.1)	21.3	22.0 (22.3)	23.2 (23.8)	25.1 (25.2)	27.1 (26.9)	28.6 (29.0)	29.5	(31.5)
2	215	(23.3)	23.3	24.0 (24.7)	25.7 (26.3)	27.7 (27.7)	29.5 (29.7)	31.7 (31.9)	32.6	(34.9)
2-1/2	200	(25.2)	25.3	26.2 (26.6)	27.5 (28.4)	30.1 (30.0)	32.3 (32.2)	34.5 (34.5)	35.2	(37.0)
3	205	(27.0)	26.8	28.2 (28.7)	29.9 (30.3)	32.4 (32.2)	34.3 (34.5)	36.7 (36.8)	38.3	(39.2)
3-1/2	195	(28.5)	29.0	30.4 (30.4)	32.1 (32.3)	34.5 (34.3)	37.2 (36.7)	39.4 (39.1)	40.0	(41.5)
4	195	(30.1)	30.6	32.1 (32.1)	33.7 (34.0)	36.7 (36.4)	39.6 (39.0)	42.2 (41.4)	43.3	(44.3)
4-1/2	185	(31.6)	32.3	33.7 (33.8)	35.9 (35.7)	39.2 (38.4)	41.4 (41.4)	44.7 (43.9)	46.4	(47.4)
5	181	(33.6)	33.7	35.4 (35.5)	38.1 (37.5)	41.4 (40.5)	44.2 (44.1)	47.3 (46.7)	49.1	(50.4)

STATURE OF MALES FROM ONE TO FIVE YEARS OF AGE

Age (year)	Number of Subjects	CENTIMETERS (percentiles)												
		3rd	5th	10th	25th	50th	75th	90th	95th	97th				
1	210	(71.3)	71.8	(72.4)	74.5	(73.7)	75.9	(75.2)	77.5	(76.9)	79.6	(78.1)	80.7	(80.3)
1-1/2	201	(77.5)	78.6	(78.8)	81.0	(80.3)	82.5	(81.8)	84.6	(83.7)	86.6	(85.0)	87.8	(88.2)
2	196	(82.7)	82.9	(84.2)	84.1	(84.2)	86.2	(85.8)	88.0	(87.5)	89.7	(91.1)	92.0	(94.6)
2-1/2	185	(86.9)	88.2	(88.5)	89.1	(90.2)	90.8	(92.1)	92.7	(94.1)	94.6	(96.2)	97.4	(99.5)
3	189	(90.6)	91.5	(92.3)	92.5	(93.9)	94.5	(96.2)	96.7	(98.5)	99.2	(100.5)	101.4	(102.8)
3-1/2	175	(94.3)	94.9	(96.0)	96.1	(97.5)	98.1	(99.8)	100.8	(102.5)	103.2	(104.5)	105.7	(106.5)
4	173	(97.5)	98.0	(99.3)	99.6	(100.8)	101.6	(103.4)	103.9	(106.5)	106.9	(108.5)	108.7	(110.4)
4-1/2	171	(100.6)	101.2	(102.4)	103.2	(104.0)	105.2	(106.7)	107.5	(109.9)	110.6	(112.3)	112.5	(114.3)
5	170	(102.0)	104.4	(103.7)	106.6	(105.9)	108.4	(108.7)	111.0	(112.3)	114.0	(114.7)	116.1	(117.1)

STATURE OF MALES FROM ONE TO FIVE YEARS OF AGE

Age (year)	Number of Subjects	INCHES (percentiles)												
		3rd	5th	10th	25th	50th	75th	90th	95th	97th				
1	210	(28.1)	28.3	(28.5)	29.3	(29.0)	29.9	(29.6)	30.5	(30.3)	31.3	(30.7)	31.8	(31.6)
1-1/2	201	(30.5)	30.9	(31.0)	31.9	(31.6)	32.5	(32.2)	33.3	(32.9)	34.1	(33.5)	34.6	(34.7)
2	196	(32.6)	32.6	(33.1)	33.9	(33.8)	34.6	(34.4)	35.3	(35.2)	36.2	(35.9)	36.7	(37.2)
2-1/2	185	(34.2)	34.7	(34.8)	35.7	(35.5)	36.5	(36.3)	37.2	(37.0)	38.3	(37.9)	39.0	(39.2)
3	189	(35.7)	36.0	(36.3)	37.2	(37.0)	38.1	(37.9)	39.1	(38.8)	39.9	(39.6)	40.7	(40.5)
3-1/2	175	(37.1)	37.4	(37.8)	38.6	(38.4)	39.7	(39.3)	40.6	(40.3)	41.6	(41.1)	42.0	(41.9)
4	173	(38.4)	38.6	(39.1)	40.0	(39.7)	40.9	(40.7)	42.1	(41.9)	42.8	(42.7)	43.5	(43.5)
4-1/2	171	(39.6)	39.8	(40.3)	41.4	(40.9)	42.3	(42.0)	43.5	(43.3)	44.3	(44.2)	44.9	(45.0)
5	170	(40.2)	41.1	(40.8)	42.7	(41.7)	43.7	(42.8)	44.9	(44.2)	45.7	(45.2)	46.5	(46.1)

WEIGHT OF FEMALES FROM ONE TO FIVE YEARS OF AGE

Age (year)	Number of Subjects	KILOGRAMS (percentiles)									
		3rd	5th	10th	25th	50th	75th	90th	95th	97th	
1	219	(7.6)	7.7	8.0 (8.4)	8.8 (9.0)	9.5 (9.8)	10.1 (10.4)	10.8 (11.3)	11.2	(12.3)	
1-1/2	211	(8.8)	9.0	9.4 (9.6)	10.0 (10.3)	10.7 (11.1)	11.5 (11.9)	12.2 (12.8)	12.8	(14.0)	
2	204	(9.8)	9.9	10.2 (10.7)	11.1 (11.5)	11.9 (12.3)	12.7 (13.3)	13.7 (14.4)	14.1	(15.6)	
2-1/2	200	(10.7)	10.8	11.1 (11.6)	12.1 (12.4)	12.9 (13.4)	13.9 (14.5)	14.8 (15.7)	15.3	(17.3)	
3	197	(11.6)	11.6	11.9 (12.5)	13.0 (13.4)	13.9 (14.4)	15.0 (15.7)	15.9 (17.0)	16.7	(19.0)	
3-1/2	192	(12.5)	12.4	12.8 (13.4)	13.8 (14.3)	15.0 (15.4)	16.1 (16.8)	17.2 (18.3)	17.9	(20.6)	
4	183	(13.3)	13.1	13.7 (14.2)	14.8 (15.2)	16.1 (16.4)	17.2 (18.0)	18.5 (19.7)	19.1	(21.9)	
4-1/2	174	(13.9)	13.9	14.3 (14.9)	15.4 (16.0)	16.7 (17.5)	18.6 (19.1)	19.8 (21.2)	20.5	(23.1)	
5	173	(14.6)	14.6	15.0 (15.8)	16.3 (17.0)	17.8 (18.4)	19.5 (20.3)	21.0 (22.3)	21.7	(24.0)	

WEIGHT OF FEMALES FROM ONE TO FIVE YEARS OF AGE

Age (year)	Number of Subjects	POUNDS (percentiles)													
		3rd	5th	10th	25th	50th	75th	90th	95th	97th					
1	219	(16.8)	16.9	(18.4)	17.6	(19.8)	19.4	(21.5)	20.9	(23.0)	22.2	(24.8)	23.8	(27.1)	24.6
1-1/2	211	(19.4)	19.8	(21.2)	20.7	(22.7)	22.0	(24.5)	23.5	(26.2)	25.3	(28.3)	26.8	(30.9)	28.2
2	204	(21.6)	21.8	(23.5)	22.4	(25.3)	24.4	(27.1)	26.2	(29.2)	27.9	(31.7)	30.1	(34.4)	31.0
2-1/2	200	(23.6)	23.7	(25.5)	24.4	(27.4)	26.6	(29.6)	28.4	(31.9)	30.6	(34.6)	32.6	(38.2)	33.7
3	197	(25.6)	25.5	(27.6)	26.2	(29.6)	28.6	(31.8)	30.6	(34.6)	33.0	(37.4)	35.0	(41.8)	36.7
3-1/2	192	(27.5)	27.3	(29.5)	28.2	(31.5)	30.4	(33.9)	33.0	(37.0)	35.4	(40.4)	37.8	(45.3)	39.4
4	183	(29.2)	28.8	(31.2)	30.1	(33.5)	32.6	(36.2)	35.4	(39.6)	37.8	(43.5)	40.7	(48.2)	42.0
4-1/2	174	(30.7)	30.6	(32.9)	31.5	(35.3)	33.9	(38.5)	36.7	(42.1)	40.9	(46.7)	43.6	(50.9)	45.1
5	173	(32.1)	32.1	(34.8)	33.0	(37.4)	35.9	(40.5)	39.2	(44.8)	42.9	(49.2)	46.2	(52.8)	47.7

STATURE OF FEMALES FROM ONE TO FIVE YEARS OF AGE

Age (year)	Number of Subjects	CENTIMETERS (percentiles)									
		3rd	5th	10th	25th	50th	75th	90th	95th	97th	
1	206	(68.9)	70.1	71.1 (70.6)	72.7 (72.3)	74.1 (74.2)	75.9 (75.9)	78.1 (77.1)	79.3	(78.8)	
1-1/2	197	(74.9)	76.7	78.0 (76.8)	79.0 (79.0)	80.9 (80.9)	83.0 (82.9)	84.6 (84.5)	85.8	(86.7)	
2	194	(80.1)	82.5	83.2 (82.0)	84.6 (84.7)	86.8 (86.6)	88.9 (88.9)	90.4 (91.0)	92.0	(93.3)	
2-1/2	184	(84.5)	86.4	87.4 (86.3)	89.1 (89.3)	91.6 (91.4)	93.5 (93.8)	95.9 (96.4)	96.7	(98.7)	
3	184	(88.4)	89.9	90.8 (90.5)	93.1 (93.4)	95.5 (95.7)	97.9 (98.1)	100.0 (101.1)	101.6	(103.5)	
3-1/2	174	(92.0)	93.6	95.1 (94.2)	96.9 (96.9)	99.4 (99.5)	101.9 (102.0)	104.7 (105.4)	106.2	(108.0)	
4	175	(95.2)	96.5	98.1 (97.6)	100.3 (100.3)	103.2 (103.2)	105.6 (105.8)	108.3 (109.6)	110.3	(112.3)	
4-1/2	161	(98.1)	99.4	101.3 (100.9)	103.6 (103.6)	106.2 (106.8)	109.4 (109.3)	112.3 (113.5)	113.9	(116.2)	
5	161	(100.0)	102.7	104.2 (103.0)	107.6 (105.7)	109.8 (109.1)	113.0 (111.7)	115.9 (115.4)	117.4	(118.8)	

STATURE OF FEMALES FROM ONE TO FIVE YEARS OF AGE

Age (year)	Number of Subjects	INCHES (percentiles)									
		3rd	5th	10th	25th	50th	75th	90th	95th	97th	
1	206	(27.1)	27.6	28.0 (27.8)	28.6 (28.5)	29.2 (29.2)	29.9 (29.9)	30.7 (30.3)	31.2	(31.0)	
1-1/2	197	(29.5)	30.2	30.7 (30.2)	31.1 (31.1)	31.8 (31.8)	32.7 (32.6)	33.3 (33.3)	33.8	(34.1)	
2	194	(31.5)	32.5	32.8 (32.3)	33.3 (33.3)	34.2 (34.1)	35.0 (35.0)	35.6 (35.8)	35.2	(36.7)	
2-1/2	184	(33.3)	34.0	34.4 (34.0)	35.1 (35.2)	36.1 (36.0)	36.8 (36.9)	37.8 (37.9)	38.1	(38.9)	
3	184	(34.8)	35.4	35.7 (35.6)	36.7 (36.8)	36.7 (37.7)	38.5 (38.6)	39.4 (39.8)	40.0	(40.7)	
3-1/2	174	(36.2)	36.8	37.4 (37.1)	38.1 (38.1)	39.1 (39.2)	40.1 (40.2)	41.2 (41.5)	41.8	(42.5)	
4	175	(37.5)	38.0	38.6 (38.4)	39.5 (39.5)	40.6 (40.6)	41.6 (41.6)	42.6 (43.1)	43.4	(44.2)	
4-1/2	161	(38.6)	39.1	39.9 (39.7)	40.8 (40.8)	41.8 (42.0)	43.1 (43.0)	44.2 (44.7)	44.8	(45.7)	
5	161	(39.4)	40.4	41.0 (40.5)	42.4 (41.6)	43.2 (42.9)	44.5 (44.0)	45.6 (45.4)	46.2	(46.8)	

CONDUCTING BIOCHEMICAL AND ROENTGENOGRAPHIC STUDIES

Because some method of standardization of biochemical results from one laboratory to another is desirable, and because in some communities in which preschool children receive care, microchemical methods will not be available, a reference laboratory is being established.*

This laboratory will be available on a fee-for-service basis to aid in quality control. Presumably, methods being used in a local laboratory might be checked approximately once monthly by sending a few specimens of serum, plasma, or urine to the reference laboratory. And, for selected projects, the majority of the biochemical analyses might be done by the reference laboratory on a fee-for-service basis.

Biochemical studies that require timed collections of blood and/or urine are not generally feasible and have therefore not been considered in these guidelines.

Studies of Blood

Biochemical studies of blood can aid greatly in evaluating a child's nutritional status. Such studies require a person skilled in collection of venous or capillary blood, and the same, or an additional, person trained to carry out laboratory determinations promptly, to separate cells from plasma, and to store these in a manner that will permit subsequent determinations.

All determinations listed can be done on a combined sample of 0.5 ml of whole blood although a larger sample (1.0 to 2.0 ml) is preferable. When it is not possible or practical to obtain venous blood from the ante-cubital or external jugular vein (the femoral vein is not recommended), several of the determinations listed can be performed on an amount of capillary blood readily obtained from a heel or a fingertip.

*Inquiries about the location of this laboratory and arrangements that can be made for service may be obtained by writing to the Department of Health, Education, and Welfare, Children's Bureau, Division of Health Services, Nutrition Section, Washington, D.C. 20201.

The following steps are necessary soon after the blood has been obtained: (1) determine hemoglobin concentration; (2) determine hematocrit; (3) separate cells from plasma; and (4) freeze plasma and cells for subsequent determination locally or for shipment to the reference laboratory.

The various determinations have been listed in the order of their probable usefulness to evaluate the nutritional status of the preschool child in the United States. Priority ranking may be changed depending upon local conditions. Methods recommended for the various determinations and information of value in interpretation are also presented.

Studies of Urine

Since only randomly voided specimens of urine will be available for analysis, the ratio of concentration of a questioned substance to a concentration of creatinine is used as a rough index of the rate of excretion of the questioned substance. This is an admittedly insensitive method of assay, but it may provide information of value. The collection of even a few milliliters of urine will be sufficient for performing the analyses listed.

The ratio of total nitrogen to creatinine in urine provides an index of the recent dietary intake of protein.

The ratio of riboflavin to creatinine in urine reflects a recent dietary intake of riboflavin.

The ratio of thiamine to creatinine reflects a more remote dietary intake of thiamine, e.g., the intake of the past few weeks or months rather than that of the past few days.

Roentgenogram

Unless a roentgenologist experienced in detecting early evidences of rickets and scurvy in roentgenograms of the wrist is available, such roentgenograms will probably not provide sufficient information to justify their inclusion. When a roentgenogram is made, it is highly desirable that biochemical studies of plasma include ascorbic acid and alkaline phosphatase.

And, every effort should be made to minimize gonadal exposure. By adhering to procedures described by Garn et al.,* average gonadal (skin) dosages will be less than 0.3 milliroentgen, which is less than the radiation load accumulated by a person during one day of normal living.

BIOCHEMICAL AND ROENTGENOGRAPHIC STUDIES

Whole Blood

hemoglobin
hematocrit

Red Blood Cells (or whole blood)

transketolase

Serum or Plasma

albumin (serum only)
iron
iron-binding capacity
ascorbic acid
vitamin A and beta-carotene
alkaline phosphatase

Urine

creatinine
total N or urea
riboflavin
thiamine

Roentgenogram

wrist

*Garn, S. M., Silverman, F. N. and Davis, A. A.: Gonadal Dosages in Investigative Radiography. SCIENCE, 143:1039, 1964.

BIOCHEMICAL METHODS AND REMARKS REGARDING INTERPRETATION

<u>Substance</u>	<u>Method</u>	<u>Interpretation</u>
hemoglobin (blood)	cyanomethemoglobin ^{1a}	Concentration of hemoglobin (Hb) less than 10.0 gm/100 ml and/or volume of packed RBC's less than 30% is assumed to indicate anemia.
hematocrit (blood)	capillary tube ^{2a}	Mean corpuscular Hb concentration less than 30 gm/100 ml of packed RBC's indicates hypochromia and is strong presumptive evidence of iron deficiency.
iron (plasma or serum)	complex of iron with 2,2'-dipyridyl ³ or tripyridyl-s-triazine [*]	Concentration of iron in serum less than 45 µg/100 ml ⁴ suggests iron deficiency even when hemoglobin concentration is greater than 10 gm/100 ml.
total protein (serum)	microbiuret ^{1b}	
albumin (serum)	electrophoresis ⁵ (cellulose acetate analytical scanning)	Concentration of albumin less than 3.5 gm/100 ml suggests poor protein nutritional status. ⁶

^{*}Method as described by O'Brien and Ibbott^{2b} except that tripyridyl-s-triazine is used instead of dipyridyl.

<u>Substance</u>	<u>Method</u>	<u>Interpretation</u>
ascorbic acid (plasma or serum)	2, 4-DNP reaction ⁷	Concentration less than 0.3 mg/100 ml suggests that recent dietary intake has been low.
vitamin A (plasma or serum)	trifluoroacetic acid chromogen ⁸ or kerosene- xylene extraction ^{2c}	Concentration less than 10 µg/100 ml suggests deficiency and concentration less than 20 µg/100 ml indicates low stores.
beta-carotene (plasma or serum)	spectrophotometric ⁸ or kerosene-xylene extraction ^{2c}	Concentration less than 40 µg/100 ml indicates that recent dietary intake has been low.
alkaline phosphatase (serum)	liberation of p- nitrophenol ⁹	Activity greater than 8 p-nitrophenyl phosphate units (Bessey-Lowry units*) per 100 ml is suggestive of rickets.
iron-binding capacity (plasma or serum)	see method for iron**	Total iron-binding capacity greater than 600 µg/100 ml or saturation of iron-binding capacity less than 12% suggests iron deficiency.

*1 Bessey-Lowry unit is approximately equivalent to 1.8 Bodansky units and to 7.3 King-Armstrong units.

**In addition, a relatively minor adaptation of the method of Ressler and Zak (1958) permits use on a micro scale.

<u>Substance</u>	<u>Method</u>	<u>Interpretation</u>
transketolase (whole blood or RBC)	hexose phosphate generation ¹¹ or sedoheptulose generation ^{12*}	TPP (thiamine pyrophosphate) effect of 15% or higher suggests marginal thiamine depletion and TPP effect greater than 25% indicates deficiency. Transketolase activity less than 70 S-7-P µg/ml/hour suggests thiamine deficiency.
creatinine (urine)	alkaline picrate ^{1c}	Used as reference for other urinary constituents.
total nitrogen (urine)	digestion and Nesslerization ^{1d}	Excretion of less than 8 mg total nitrogen per mg of creatinine indicates low recent dietary intake of protein.
riboflavin (urine)	fluorometry with irradiated blank ^{1e}	Excretion of less than 125 µg per gram of creatinine suggests low recent dietary intake.
thiamine (urine)	thiochrome fluorometry ^{1f}	Excretion of less than 100 µg per gram of creatinine suggests that dietary intake has been low for weeks or months.

*The method of Dreyfus is recommended when it is necessary to perform the determination with less than 0.1 ml of blood.

QUESTIONS TO PROVIDE ASSESSMENT OF DIETARY INTAKE

Detailed information about dietary intake can provide information of great value, but such information is of little use if collected by an untrained interviewer. In truth, incomplete information about dietary intake is of so little value it is useless to obtain it.

The dietary collection method to be used in assessing nutritional status will depend upon the level of data to be collected (individual or group), the amount of information necessary, the scope of problem, the competence and number of staff, etc.

If one is concerned about the individual, for example, it is important to get a quality of data which can be compared with other clinical and laboratory findings. The 24-Hour Recall Method (included in the Guidelines) is not an appropriate or adequate method for this purpose. Rather, a complete and accurate type of dietary history designed to measure the average nutrient intake of an individual over a considerable period of time is preferred. This method requires an interviewer with special training and experience in the use of the method as well as considerable background in nutrition and the allied sciences.

The dietary history method is not included in these guidelines because it is thought to be more difficult to administer to large population groups. Therefore, for details about this method the reader, if interested, is referred to Burke, B.: The Dietary History as a Tool in Research. JOURNAL OF AMERICAN DIETETIC ASSOCIATION, 23, December 1947; or to Beal, V. A.: Nutritional Intake of Children: Calories, Carbohydrate, Protein, Fat. JOURNAL OF NUTRITION, 50, 223, 1953.

For population group studies, the 24-Hour Recall Method (and a cross check questionnaire) may give information of considerable value. In using this method, it is more important that many individuals be represented than that detailed information be acquired on a single individual. The objectives of including an assessment of dietary intake in a study of the nutritional status of groups of children include:

1. Obtaining information on levels of nutrient intake of preschool children in the United States, reported as group summaries of age, sex, and other characteristics; and

2. Obtaining descriptive information on preschool children's patterns of eating and the influence of behavioral and environmental factors.

Following are sample forms for a 24 Hour Recall Record (Form A) and a Dietary Questionnaire (Form B), as well as brief Guidelines for Interviewers. These forms are primarily designed for use with a representative sampling of preschool children. The size of the sample will vary with the categories into which the data are to be broken down for group comparison purposes.

Form A (the 24 Hour Recall Record) contains questions designed for coding by a computer which can be used with the U.S. Department of Agriculture publication "Calculating the Nutritive Value of Diets, A Manual of Instructions for the Use of Punch Cards for Machine Tabulation" ARS 62-10.

Form B (the Dietary Questionnaire) is intended for use as a cross check on the 24 Hour Dietary Recall.

Additional information about the dietary patterns and food habits of preschool children useful in determining emphasis in nutrition education can be obtained by using Forms A and B.

It is recommended that this material be utilized by trained interviewers with supervision from an individual specially trained in obtaining dietary recall information. When the forms for assessing dietary intake are properly used, they will enhance the value of other information.

A well-qualified nutritionist might be called upon to advise on selection of a method for collecting dietary intake information in specific situations and also on a method for analyzing and processing data collected.

Form A - 24 Hour Recall

Name _____ Date & Time of Interview _____
Length of Interview _____
Date of Recall _____

Day of the week of Recall:

1-M 2-T 3-W 4-Th 5-F 6-Sat 7-Sun

"I would like you to tell me about everything your child ate and drank from the time he got up in the morning until the time he went to bed at night. Be sure to mention everything he ate or drank at home, at school, and away from home. Include snacks and drinks of all kinds and everything else he put in his mouth and swallowed. I also need to know where he ate the food, but now let us begin with:

WHAT TIME DID HE GET UP YESTERDAY? _____

WAS IT THE USUAL TIME? _____

WHAT WAS THE FIRST TIME HE ATE OR HAD ANYTHING TO DRINK
YESTERDAY MORNING? (list below)

WHERE DID HE EAT? (list below using code*)

NOW TELL ME WHAT HE HAD TO EAT AND HOW MUCH? (Another
prodding question which interviewer can use periodically):

WHEN DID HE EAT AGAIN? OR, IS THERE ANYTHING ELSE? (list below)

*Code

H - Home
R - Restaurant, drug store or
lunch counter
CL- Carried lunch from home
CC- Child care center

OH- Other home (of a friend,
babysitter, or relative)
FD- Food Dispenser

Form B - DIETARY QUESTIONNAIRE

1. How many days a week does he eat a --
morning meal? _____
lunch or mid-day meal? _____
evening meal? _____
2. How many days a week does he have snacks --
in mid-morning? _____
in mid-afternoon? _____
in evening? _____
3. Which meals does he usually eat with your family?
None _____ Breakfast _____ Lunch _____ Evening Meal _____
4. Does he drink fruit juice? YES _____ NO _____
If YES, how often does he drink it? in a day _____ OR in a week _____
What kind of fruit juice? _____
5. Does he eat fruit (including canned, frozen, fresh)? YES _____ NO _____
If YES, how often does he eat it? in a day _____ OR in a week _____
6. What is his favorite fruit? _____
If a specific fruit is named, how many times did he have it last week?

7. Does he eat dried cereals such as cornflakes, puffed rice, shredded
wheat, etc? YES _____ NO _____
If YES, how often does he have them? in a day _____ OR in a week _____
Which kind does he most often eat? _____

8. Does he eat cooked cereals such as oatmeal, cream of wheat, grits, etc? YES _____ NO _____
 If YES, how often does he have them? in a day _____ OR in a week _____
 Which kind does he most often eat? _____
9. Does he have meat for breakfast, e.g., bacon, sausage, or ham?
 YES _____ NO _____
 If YES, how many times a week does he have it? _____
10. Does he eat eggs? YES _____ NO _____
 If YES, how often does he eat them? in a day _____ OR in a week _____
11. Does he drink milk or milk beverages (including whole, half-skimmed, skim, buttermilk, chocolate, or coffee-flavored milk drink)?
 YES _____ NO _____
 If YES, how many glasses does he drink? in a day _____ in a week _____
 What kind of milk does he drink? whole _____ skim _____ 2% milk _____
 If he does not drink milk, what does he drink? _____
12. Does he eat sweet rolls, doughnuts or crackers? YES _____ NO _____
 If YES, how often does he have them? in a day _____ OR in a week _____
13. Does he eat sandwiches (include hamburger sandwiches and hot dogs)?
 YES _____ NO _____
 If YES, how often does he have them? in a day _____ OR in a week _____
14. Does he eat bread, toast or rolls, pancakes, waffles (in addition to that used in sandwiches above)? YES _____ NO _____
 If YES, how many slices or rolls does he have? in a day _____ OR in a week _____

15. Does he have meat for lunch, e.g. hot dogs, hamburger, luncheon meat, etc?
 YES. NO If YES, how many times a week does he have it? _____
16. Does he eat lunch at a child care center? YES _____ NO _____
 If YES, is a hot lunch served in his center? YES _____ NO _____
 If YES, how many times a week does he eat the hot lunch served at the center? _____
17. Is milk available at the center? YES _____ NO _____
 If YES, how many times a week does he drink it? _____
18. Does he eat cheese? YES _____ NO _____
 If YES, how often does he eat it? in a day _____ OR in a week _____
 Which kind does he most often eat? _____
19. Does he have meat or chicken for the evening meal? YES _____ NO _____
 If YES, how many times a week does he have it? _____
20. Does he eat liver? YES _____ NO _____
 If YES, how often does he have it? In a week _____ OR in a month _____
21. Does he eat fish? YES _____ NO _____
 If YES, how often does he have it? In a week _____ OR in a month _____
22. Does he eat potatoes? YES _____ NO _____
 If YES, how often does he have them? In a day _____ OR in a week _____
23. Does he eat cooked vegetables other than potatoes? YES _____ NO _____
 If YES, how often does he have them? In a day _____ OR in a week _____
 Which kind does he most often eat? _____

24. Does he have dried peas or beans as often as once a week?
 If YES, how often does he have them? In a day _____ OR in a week _____
25. Does he eat raw vegetables, including salads? YES _____ NO _____
 If YES, how often does he have them? In a day _____ OR in a week _____
 Which kind does he most often eat? _____
26. Does he eat macaroni, spaghetti, rice or noodles? YES _____ NO _____
 If YES, how often does he have it? In a day _____ OR in a week _____
27. Does he eat milk puddings, custards or cream soups? YES _____ NO _____
 If YES, how often does he eat them? In a day _____ OR in a week _____
28. Does he eat pies, cakes, or cookies? YES _____ NO _____
 If YES, how often does he have them? In a day _____ OR in a week _____
 Which kind does he most often eat? _____
29. Does he eat ice cream (including sundaes and sodas) as often as once
 a week? YES _____ NO _____
 If YES, how often does he have it? In a day _____ OR in a week _____
30. Does he drink coke, soda, tonics or other carbonated beverages?
 YES _____ NO _____
 If YES, how many times does he have it? In a day _____ OR in a week _____
 Is it usually the regular kind _____ OR the low-calorie kind _____
31. Does he eat candy? YES _____ NO _____
 If YES, how often does he eat it? In a day _____ OR in a week _____

32. How many times per week does he eat the following foods as snacks?

Circle the appropriate number.

	0	1	2	3	4	5	6	7	if more, specify	_____
Meat	0	1	2	3	4	5	6	7	"	"
Cheese	0	1	2	3	4	5	6	7	"	"
Sandwiches	0	1	2	3	4	5	6	7	"	"
Candy	0	1	2	3	4	5	6	7	"	"
Soft drinks	0	1	2	3	4	5	6	7	"	"
Doughnuts or sweet rolls	0	1	2	3	4	5	6	7	"	"
Cookies, cake, or pie	0	1	2	3	4	5	6	7	"	"
Fruit and fruit juices	0	1	2	3	4	5	6	7	"	"
Milk and milk beverages	0	1	2	3	4	5	6	7	"	"
Potato chips, pretzels, fritos, etc.	0	1	2	3	4	5	6	7	"	"
Peanuts, other nuts	0	1	2	3	4	5	6	7	"	"
Ice cream	0	1	2	3	4	5	6	7	"	"
Crackers	0	1	2	3	4	5	6	7	"	"
Crackers with spread, e.g., cellophane package	0	1	2	3	4	5	6	7	"	"

33. Is he on a special diet now? YES _____ NO _____

If YES, why is he on a diet? (check)

- _____ for weight reduction (own prescription)
- _____ for weight reduction (physician's prescription)
- _____ for gaining weight
- _____ for other reasons, specify _____

If NO, has he been on a special diet within the past year? YES _____ NO _____

If YES, for what reason? _____

34. Does he have a good appetite? YES _____ NO _____

If NO, for what reason? _____

At what time of day is he most hungry? Morning _____ Afternoon _____ Evening _____

35. What foods does he dislike? _____

36. Does he feed himself? YES _____ NO _____
With a spoon? YES _____ NO _____
Use a cup? YES _____ NO _____
With his fingers? YES _____ NO _____
37. Does he still drink from bottle? YES _____ NO _____

GUIDELINES FOR INTERVIEWERS

- I. How questions are asked is important, e.g.:
 - (a) Avoid questions that suggest the correct answers, e.g.
"Did you have a dark-green or deep-yellow vegetable today?"
 - (b) Avoid expressing or showing approval or disapproval of the foods reported.
 - (c) If you feel there are omissions, ask questions such as:
"What did you drink with your lunch?" "What did you have in your coffee?"

- II. Check carefully for the following information to help complete the 24 hour intake form:
 - A. Additions to foods recorded, such as:
 1. Fats: butter, margarine, honey-butter, peanut butter, mayonnaise, lard, meat drippings, cheese spreads, and others.

Used on toast, bread, rolls, buns, cookies, crackers, sandwiches

Used on vegetables

Used on potatoes, rice, noodles, etc.

Used on other foods
 2. Sugar: jam, jelly, honey, syrup, sweetening, etc.
Used on breads, sandwiches, vegetables, fruit, cereal, coffee, tea, other foods
 3. Other spreads: catsup, mustard, etc.
 4. Milk: cream, half and half, skim milk, etc.

Used on cereal, coffee, tea, desserts, other foods.

5. Gravies: Used on bread, biscuits, meat, potatoes, rice, noodles, other foods
6. Salad dressings: Used on vegetables, salads, sandwiches, other foods
7. Chocolate or other flavorings to milk, e.g., Quik, Bosco.

B. Food Preparation

1. Preparation of eggs, e.g., fried, scrambled, boiled, poached
2. Preparation of meat, poultry, fish, e.g., fried, boiled, stewed, roasted, baked, broiled
3. Preparation of mixed dishes -- major ingredients used, e.g., tuna fish and noodles, macaroni and cheese
4. Special preparation of food -- strained, chopped, etc.

C. Specific, additional detail about food items

1. Kinds of carbonated beverages consumed, e.g., regular, low-caloried
2. Fruits, e.g., canned, frozen, fresh, dried, cooked with sugar added

III. Carry a few standardized props to facilitate obtaining more accurate recording of amounts. For example:

Teaspoon and tablespoon

Different sizes of glasses, bowls, etc. (including a 4 oz. and 8 oz. measure)

Something to indicate thickness of meat. Could be a plastic, lightweight ruler or some standard form, such as a model of a slice of bread.

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Children's Bureau Meeting on Preparation of Guidelines
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