Guidelines for Classification and Interpretation of Group Blood and Urine Data Collected as Part of the National Nutrition Survey

R. M. O'NEAL, O. C. JOHNSON and A. E. SCHAEFER

United States Department of Health, Education and Welfare, Health Services and Mental Health
Administration, Regional Medical Programs Service, Nutrition Program, Bethesda, Maryland, USA

During the past few months interest in the nutritional health status of United States populations has increased by several magnitudes. This interest has resulted in a number of studies designed to objectively ascertain the current status of nutritional health in this country. One portion of such objective evaluations usually consists of a number of biochemical determinations on blood and urine that are related to intake, excretion or storage, or both, of specific nutrients. To relate data obtained from such biochemical measurements to nutritional health status, they must be compared with biochemical values deemed to reflect various degrees

of nutritional health status. Such a set of values has been developed to interpret the data currently being collected as part of the National Nutrition Survey (NNS). Since it is a national survey and the results obtained will be used by numerous groups concerned with nutritional health and for comparison with other nutritional health studies, the guidelines developed for classification and interpretation of group blood and urine data collected as part of the NNS should be made available to interested groups.

Prior to the beginning of the NNS, considerable amounts of information were available relating biochemical measurements to dietary and clinical nutrition status, but a current set of comprehensive guidelines suitable for interpretation of the biochemical data generated by the NNS was not available. The guidelines that had been suggested for interpretation

Table II. Methodology used to obtain National Nutrition Survey laboratory data

Determination	Method
Hemoglobin	Cyanmethemoglobin ¹
Hematocrit	Micromethod ²
Serum iron	Giovanniello ³
Serum iron-binding capacity	Caraway ⁴
Blood folacin	<i>Lactobacillus casei</i> ⁵
Total serum protein	Biuret ⁶
Serum albumin	2-(4'-hydroxyazobenzene) benzoic acid (HABA) ⁶
Serum vitamin C	Macro dinitrophenyl-hydrazine ¹
Plasma carotene and vitamin A	Macro Carr-Price (trifluoroacetic acid chromogen) ¹
Urinary creatinine	Picrate ⁶
Urinary thiamine	Thiochrome ¹
Urinary riboflavin	Modified Slater-Morell ¹
Urinary iodine	Modified Zak ¹

¹ Manual for nutrition surveys, 2nd ed., Interdepartmental Committee on Nutrition for National Defense, 1963.

² M.M.Wintrobe: Clinical hematology, 6th ed. (Lea & Febiger, Philadelphia 1967).

³ Modified procedure: Giovanniello, T.J.; DiBenedetto, G.; Palmer, D.W. and Peters, T., Jr.: Fully and semi-automated methods for the determination of serum iron and total iron-binding capacity. J. Lab. Clin. Med. 71: 874 (1968).

⁴ Modified procedure: Caraway, W.T.: Macro and micro methods for the determination of serum iron and iron-binding capacity. Clin. Chem. 9: 188 (1963).

⁵ Modified by U.S. Army Medical Research and Nutrition Laboratory, Fitzsimons General Hospital, Denver, Colo.

⁶ Technicon auto analyzer methodology, Technicon Instruments Corporation, Chauncey, N.Y.

Table I. Guidelines for classification and interpretation of group blood and urine data collected as part of the National Nutrition Survey

Determination	Classification category		
	Less than acceptable Deficient	Low	Acceptable ¹
Hemoglobin, g/100 ml			
6-23 months	< 9.0	9.0- 9.9	≥ 10.0
2- 5 yr	< 10	10.0-10.9	≥ 11.0
6-12 yr	< 10	10.0-11.4	≥ 11.5
13-16 yr, male	< 12	12.0-12.9	≥ 13.0
13-16 yr, female	< 10	10.0-11.4	≥ 11.5
> 16 yr, male	< 12	12.0-13.9	≥ 14.0
> 16 yr, female	< 10	10.0-11.9	≥ 12.0
Pregnant, 2nd trimester	< 9.5	9.5-10.9	≥ 11.0
Pregnant, 3rd trimester	< 9.0	9.0-10.4	≥ 10.5
Hematocrit, %			
6-23 months	< 28	28-30	≥ 31
2- 5 yr	< 30	30-33	≥ 34
6-12 yr	< 30	30-35	≥ 36
13-16 yr, male	< 37	37-39	≥ 40
13-16 yr, female	< 31	31-35	≥ 36
> 16 yr, male	< 37	37-43	≥ 44
> 16 yr, female	< 31	31-37	≥ 38
Pregnant, 2nd trimester	< 30	30-34	≥ 35
Pregnant, 3rd trimester	< 30	30-32	≥ 33
Hemoglobin conc, MCHC, g/100 ml RBC			
All ages	—	30	≥ 30
Serum iron, µg/100 ml			
0- 5 months	—	—	—
6-23 months	< 30		≥ 30
2- 5 yr	< 40		≥ 40
6-12 yr	< 50		≥ 50
> 12 yr, male	< 60		≥ 60
> 12 yr, female	< 40		≥ 40
Transferrin saturation, %			
0- 5 months	—	—	—
6-23 months	< 15		≥ 15
2-12 yr	< 20		≥ 20
> 12 yr, male	< 20		≥ 20
> 12 yr, female	< 15		≥ 15
Red cell folacin, ng/ml			
All ages	< 140	140-159	≥ 160-650
Serum folacin, ng/ml	3.0	3.0- 5.9	≥ 6.0
Serum protein, g/100 ml			
0-11 months		< 5.0	≥ 5.0
1- 5 yr		< 5.5	≥ 5.5
6-17 yr		< 6.0	≥ 6.0
Adult	< 6.0	6.0- 6.4	≥ 6.5
Pregnant, 2nd and 3rd trimester	< 5.5	5.5- 5.9	≥ 6.0

Table I. (Continued)

Determination	Classification category		
	Less than acceptable Deficient	Low	Acceptable ¹
Serum albumin, g/100 ml			
0-11 months		< 2.5	≥ 2.5
1- 5 yr		< 3.0	≥ 3.0
6-17 yr		< 3.5	≥ 3.5
Adult	< 2.8	2.8-3.4	≥ 3.5
Pregnant, 1st trimester	< 3.0	3.0-3.9	≥ 4.0
Pregnant, 2nd and 3rd trimester	< 3.0	3.0-3.4	≥ 3.5
Serum vitamin C, mg/100 ml			
0-11 months	—	—	—
≥ 1 yr	< 0.1	0.1-0.19	≥ 0.2
Plasma carotene, µg/100			
0- 5 months		< 10	≥ 10
6-11 months		< 30	≥ 30
1-17 yr		< 40	≥ 40
Adult	< 20 ²	20-39	≥ 40
Pregnant, 2nd trimester		30-79	≥ 80
Pregnant, 3rd trimester		40-79	≥ 80
Plasma vitamin A, µg/100 ml			
0-5 months	< 10	10-19	≥ 20
0.5-17 yr	< 20	20-29	≥ 30
Adult	< 10	10-19	≥ 20
Urinary thiamine, µg/g creatinine			
1- 3 yr	<120	120-175	≥ 176
4- 6 yr	< 85	85-120	≥ 121
7- 9 yr	< 70	70-180	≥ 181
10-12 yr	< 60	60-180	≥ 181
13-15 yr	< 50	50-150	≥ 151
Adult	< 27	27- 65	≥ 66
Pregnant, 2nd trimester	< 23	23- 54	≥ 55
Pregnant, 3rd trimester	< 21	21- 49	≥ 50
Urinary riboflavin, µg/g creatinine			
1- 3 yr	<150	150-499	≥ 500
4- 6 yr	<100	100-299	≥ 300
7- 9 yr	< 85	85-269	≥ 270
10-15 yr	< 70	70-199	≥ 200
Adult	< 27	27- 79	≥ 80
Pregnant, 2nd trimester	< 39	39-119	≥ 120
Pregnant, 3rd trimester	< 30	30- 89	≥ 90
Urinary iodine, µg/g creatinine			
	< 25	25- 49	≥ 50

¹ Excessively high levels may indicate abnormal clinical status or toxicity.² May indicate unusual diet or malabsorption.

of biochemical data by the Interdepartmental Committee on Nutrition for National Defense (ICNND) [2] were selected as a starting point and revised and expanded to accommodate the scope of data collected from the NNS. The Committee on Nutrition of the American Academy of Pediatrics reviewed the ICNND guidelines for interpretation of blood data, and revised them when necessary, based on current information [1]. The Committee expanded them to accommodate the significant physiological differences in children due to sex and age through 16 years of age, as well as providing guidelines for additional determinations performed in the NNS.

The Nutrition Program Advisory Committee reviewed the ICNND guidelines for interpretation of blood and urine data for adults and revised them where current information required revision. This committee expanded these guidelines to include standards

for interpretation of additional determinations performed in the NNS.

The comprehensive guidelines for classification and interpretation of group blood and urine data collected as part of the NNS are shown in table I and are for laboratory data obtained by the methods referenced in table II.

References and Notes

1. Diseases related to nutrition, rates and rank order; Systems Development Project Staff, Minneapolis, Minnesota, 1968.
2. Manual for nutrition surveys, 2nd ed., Interdepartmental Committee on Nutrition for National Defense, 1963.
3. Accepted for publication October 13, 1969.