B. Nutrition

Anthropometry

Mei Z, Grummer-Strawn LM, Onis M *et al*. The development of a MUAC-for-height reference, including a comparison to other nutritional status screening indicators. Bulletin of the World Health Organization 1997;75(4):333-41

Meegan M, Morley DC, Brown R.. Child weighing by the unschooled: a report of a controlled study of growth monitoring over 12 months of Maasai children using direct recording scales. Transactions of the Royal Society of Tropical Medicine and Hygiene 1994;88(6):635-7

Pelletier DL. The relationship between child anthropometry and mortality in developing countries: implications for policy, programs and future research. Journal of Nutrition 1994;124(10 Suppl):2047-2081

Pelletier DL The role of information in the planning, management and evaluation of community nutrition programs Health Policy and Planning 1994;9(2):171-184

WHO Expert Committee. Physical Status: the use and interpretation of anthropometry. In: Technical Framework. WHO Technical Report Series;1995.

Author:	**Mei Z, Grummer-Strawn LM, Onis M *et al.***
Title:	**The development of a MUAC-for-height reference, including a comparison to other nutritional status screening indicators.**
Source:	**Bulletin of the World Health Organization 1997; 75(4):333-41**

This article reports mid-upper-arm-circumference (MUAC)-for height reference and the construction and use of the Quaker-Arm-Circumference (QUAC) measuring stick. The height based QUAC-stick is a simple means of adjusting MUAC cut-offs according to height of the child. Described also is the use of the receiver operating (ROC) curve method to evaluate the performance of MUAC, MUAC for age, MUAC for height in screening malnourished children. It is demonstrated that MUC for height and MUAC for age Z-scores are better predictors of weight for height than either MUAC based on a fixed cut-off. The QUAC stick techniques can be used as a rapid method for determining levels of nutrition in large populations and as a screening tool for malnourished children.

Author:	**Meegan M, Morley DC, Brown R**
Title:	**Child weighing by the unschooled: a report of a controlled study of growth monitoring over 12 months of Maasai children using direct recording scales**
Source:	**Transactions of the Royal Society of Tropical Medicine and Hygiene 1994; 88(6):635-7**

Direct Recording Scales (DRS) have been designed to overcome some of the deficiencies in present growth monitoring programs. This study suggests that Teaching-Aids at Low Cost (TALC)-DRS allows growth monitoring to be undertaken, even by illiterate mothers in the community and reports the results of a trial with a group of illiterate mothers amongst the Masaai of Kenya. All mothers in the experimental group, who weighed their children with the DRS, showed increased understanding using all three indicators, compared to the control mothers. Authors conclude that the TALC-DRS may make it possible to involve the community in monitoring the growth of their children and help to bring about a better understanding by health workers and families of weighing, graphic representation and concept of growth.

Author:	**Pelletier DL**
Title:	**The role of information in the planning, management and evaluation of community nutrition programs**
Source:	**Health Policy and Planning 1994; 9(2):171-184**

This paper investigates the role of information in the planning, management and evaluation of several community nutrition programs judged to be successful. The review finds that the initial conceptualization and design of these programs and benefited from the results of earlier surveys and experiences with similar programs. Strong capacity for operations research is important to assist with a myriad of program details and larger mid term reevaluations.

Author:	**Pelletier DL**
Title:	**The relationship between child anthropometry and mortality in developing countries: implications for policy, programs and future research.**
Source:	**Journal of Nutrition 1994; 124(10 Suppl):2047-2081**

This paper reviews 28 community-based, prospective studies in 12 Asian and Sub-Saharan African countries, which examined the relationship between anthropometric indicators of malnutrition and child mortality. The accumulated results are consistent in showing that the risk of mortality is inversely related to anthropometric indicators of nutritional status and that there is elevated risk even in the mild to moderate range of malnutrition.

Author:	**WHO Expert Committee**
Title:	**Physical Status: the use and interpretation of anthropometry.**
Source:	**Technical Framework. WHO Technical Report Series;1995.**

This chapter provides excellent background information on the use of anthropometry as a universally applicable, inexpensive, and non-invasive method available to assess the size, proportions, and composition of the human body. Simple body measurements permit the selection of individuals, families and communities for interventions designed to improve not only nutrition but health in general and thus survival. This chapter reviews selection of anthropometric indicators depending on the objectives of their use and discusses the sensitivity and specificity of the respective indicators. The role of anthropometry in screening, targeting and evaluating interventions and its role as a component of national nutritional surveillance systems is introduced.

Obesity

Dietz WH. Use of the body mass index (BMI) as a measure of overweight in children and adolescents. The Journal of Pediatrics 1998;132(2):191-2

Dietz HD, Bellizzi MC. Introduction: the use of body mass index to assess obesity in children. American Journal of Clinical Nutrition 1999;70(Suppl):123S-125S

Durnin JVGA, DeBruin H, Feunekes GIJ. Technical note: skinfold thicknesses: is there a need to be very precise in their location? British Journal of Nutrition 1997;77:3-7

Guillaume M. Defining obesity in childhood: current practice. American Journal of Clinical Nutrition 1999;70(Suppl):126S-130S

Long AE, Prewitt TE, Kaufman JS, Rotimi CN, Cooper RS, McGee DL. Weight-height relationships among eight populations of West African origin: the case against constant BMI standards. International Journal of Obesity 1998;22:842-6

Rankinen T, Kim S-Y, Pérusse L, Després J-P, Bouchard C. The prediction of abdominal visceral fat level from body composition and anthropometry: ROC analysis. International Journal of Obesity and Related Metabolic Disorders 1999;23(8):801-9

Stewart A, Eston R. Skinfold thickness measurement. British Journal of Nutrition 1997;78(6):1040-1

Willett WC, Dietz WH, Colditz GA. Primary care: guidelines for healthy weight. The New England Journal of Medicine 1999;341(6):427-34

Author:	**Dietz WH**
Title:	**Use of the body mass index (BMI) as a measure of overweight in children and adolescents**
Source:	**The Journal of Pediatrics 1998;132(2):191-2**

This editorial comments on the use of skinfold, underwater weighing, and dual photo absortiometry (DXA) as measures of overweight and obesity in children and adolescents but concentrates on BMI. Skinfold tests suffer from low reliability, because interobserver and intraobserver reliability are difficult to establish and reliability decreases as body fat increases. Experts have decided that BMI greater than the 95th percentile should be considered a screening criterion for overweight in adolescents, but no such consensus exists for younger children. BMI has a few advantages, namely clinics routinely measure weight and height and can easily calculate BMI. Few studies, however, have examined the sensitivity, specificity, and predictive value of the persistence of obesity or the development of its complications. For adults, increased BMI is associated with excess morbidity and higher mortality rates; for children, clinically significant obesity-associated morbidities occur much less frequently. The International Task Force on Obesity has decided that the pediatric percentile identified in late adolescence by a BMI of 25 and BMI of 30 should constitute the cutoff points for the identification of childhood overweight. Few studies have analyzed populations other than whites and blacks, so caution is required when the identified cutoff points are used with other ethnic groups or foreign populations. In addition, the author prefers the use of less pejorative terms of grade 1 and grade 2 overweight. In summary, "BMI is a reliable measure with reasonable measurement and clinical validity in children and adolescents."

Author:	**Dietz HD, Bellizzi MC**
Title:	**Introduction: the use of body mass index to assess obesity in children**
Source:	**American Journal of Clinical Nutrition 1999;70(Suppl):123S-125S**

The International Task Force on Obesity (IOTF) convened a workshop on childhood obesity to determine the most appropriate measurement to assess obesity in populations of children and adolescents around the world. BMI is a widely accepted index for classifying adiposity in adults, but its validity as an index of fatness has not been carefully examined or extensively studied in younger children or adolescents. BMI above the 85th percentile could act as a screening index for overweight and above the 95th percentile as an index of excess adiposity in adolescents. Ideal measurements of body fat should correlate well with body fat in both sexes and across all ages and ethnic groups. Body fat expressed as a percent of body weight is the most relevant measure against which anthropomentric measurements should be correlated. Skinfold and other direct measurements of subcutaneous fat correlate well with percent body fat, but reproducibility between observers poses a problem to its use. Body density determined by underwater weighing or dual energy X-ray absorptiometry (DXA) offers another method of measuring body composition. Correlation coefficients of percent body fat measured with underwater weighing and BMI are generally lower than those measured with DXA and BMI.

Author:	**Durnin JVGA, DeBruin H, Feunekes GIJ**
Title:	**Technical note: skinfold thicknesses: is there a need to be very precise in their location?**
Source:	**British Journal of Nutrition 1997;77:3-7**

This study was designed to determine whether the site of skinfold testing influences the results. 98 adults (53 women and 45 men) participated in the study by having their skinfolds measured at the standard biceps, triceps, supra-iliac, and subscapular sites on the right side of the body. Several variations on the recommended skinfold location were also used. For each site, the examiners compared the skinfold at the reference or standard location to the skinfold at the deviant locations. Although many of the comparisons were significantly different, the actual amount of the difference was comparatively small and of little practical importance. With one deviant skinfold, the mean percent fatness of the group of 53 women differed by less then 0.2% fatness, and in the group of 45 men by less than 0.3%. The maximum difference within each set of comparisons (with one deviant location and three correct locations) was equivalent to 2.5% fatness for an individual women and 3% fatness for an individual man.

Author:	**Guillaume M**
Title:	**Defining obesity in childhood: current practice**
Source:	**American Journal of Clinical Nutrition 1999;70(Suppl):126S-130S**

This article analyzes the application of different standards of childhood and adolescent obesity using data from 26 different countries. Many countries, particularly those in Europe as well as in Japan, use BMI, but cutoff points for obesity vary between the 85^{th} and 97^{th} percentile, and small differences in the cutoff values may produce widely different estimates of the prevalence of obesity. Discrepancies in the prevalence of obesity may be even greater if different indexes are used. Nomenclature also varies, for example the Dutch call the 97^{th} percentile of BMI 'obesity,' but the French call it 'super-obesity.' Other countries use weight for height (such as Latin America and Asia), weight/ideal weight with a cutoff limit of > 120%, or skinfold thickness. Given the different methods, cutoff points, and reference material used worldwide, international comparisons of the prevalence of childhood obesity are difficult to make. Likewise, the definition of obesity remains unclear. For adults, the comorbidities of obesity can be used to estimate cutoff points, but this morbidity occurs less frequently in children.

Author:	**Long AE, Prewitt TE, Kaufman JS, Rotimi CN, Cooper RS, McGee DL**
Title:	**Weight-height relationships among eight populations of West African origin: the case against constant BMI standards**
Source:	**International Journal of Obesity 1998;22:842-6**

This report examines the two justifications for using BMI as an index of obesity by studying age-stratified samples of genetically similar populations of African ancestry living in different environments. 1) The regression line of weight on height should always result in the same value, and 2) BMI should be independent of height. Participants in the study hailed from urban and rural settings in Cameroon, Nigeria, Barbados, Jamaica, St. Lucia, United Kingdom, and the United States. Examiners measured weight to the nearest 0.1 kg and height to the nearest 0.1 cm and then performed ordinary linear regression of ln(weight) on ln(height). If the use of BMI is to be justified on physiological grounds, this regression should result in a line with slope 2 in each

of the samples. First the results indicate that nearly half of the slopes of the regression lines differ greatly from 2. Second, BMI does not universally result in a measure that is independent of height. Therefore, neither justification of BMI is consistent with this analysis. Furthermore, BMI is not qualitatively identical across these genetically similar populations of African descent, perhaps due to differences in body shape, perhaps due to nutrition, or perhaps due to climate. Therefore, the authors summarize, "BMI nay not be a consistent metric for health outcomes across these populations."

Author:	**Rankinen T, Kim S-Y, Pérusse L, Després J-P, Bouchard C**
Title:	**The prediction of abdominal visceral fat level from body composition and anthropometry: ROC analysis**
Source:	**International Journal of Obesity and Related Metabolic Disorders 1999;23(8):801-9**

This article lists some of the commonly used measures of obesity. Computed tomography (CT) and magnetic resonance imagery (MRI) provide valid and reliable estimates of abdominal visceral fat (AVF) level, but both methods require special and expensive equipment and are unsuitable for large groups of people. Waist circumference, waist to hit ratio (WHR), BMI, and percent body fat are also widely used indicators of obesity. BMI indicates heaviness rather than fatness, so it cannot effectively distinguish body fat from fat-free mass. Percent body fat cannot differentiate the proportion of visceral fat and subcutaneous fat. This study evaluates BMI, percent body fat, waist circumference, and WHR as predictors of AVF level. 789 Caucasian subjects participated by allowing examiners to measure their stature, body mass, waist and hip circumference, and body density by underwater weighing. AVF level was assessed by computed tomography using a Siemans Somatom DRH scanner. The study found waist circumference to be the best overall predictor of AVF level and WHR a poor indicator of AVF level, especially in women. WHR is not a good measure of abdominal visceral adipose tissue in women, because variation in both waist and hip circumference can affect its outcome. The present data indicate that the current recommendation of WHO and NIH for waist circumference to denote increased or substantially increased risk of metabolic complications in women have good sensitivity but poor specificity to detect AVF level of 150 cm squared or more. The authors conclude that "waist circumference is the best overall indicator or AVF level whereas BMI and percent body fat perform reasonably well only in younger subjects. WHR is a poor measure of AVF especially in women and should not be used as a surrogate measure of visceral obesity."

Author:	**Stewart A, Eston R**
Title:	**Skinfold thickness measurement**
Source:	**British Journal of Nutrition 1997;78(6):1040-1**

This letter to the editor comments on the article about the locations for skinfold thickness measurements written by Durnin *et al*. The authors note that the article omitted sites for the lower body "which are among the strongest predictors of subcutaneous adiposity." The Brussels Cadaver Study found that of the six best predictors of subcutaneous adipose tissue, all but one were in the lower limb and four were situated in the thigh. The thigh and calf were also among the best predictors of hydrostatically determined body density in a group of Chinese adults. The authors also add that the exact location of skinfold testing depends on the equation used (Durnin and Womersley, orJackson and Pollack)

Author:	**Willett WC, Dietz WH, Colditz GA**
Title:	**Primary care: guidelines for healthy weight**
Source:	**The New England Journal of Medicine 1999;341(6):427-34**

This article discusses the different methods of assessing body fat, the definition of healthy weight, issues pertaining to the creation of guidelines for weight, and criteria for recommendations on body circumference. Traditionally the gold standard for estimating body fat has been hydrodensitometry (underwater weighing), which is based on the principle that fat tissue is less dense than muscle or bone. Dual-energy X-ray absorptiometry is now replacing densitometry as the standard. For clinical practice and for most epidemiological studies, body fat is most commonly estimated by using a formula combining weight and height. Body mass index is the weight in kilograms divided by the square of the height in meters; this measure strongly correlates with fat mass for middle-aged adults. However, BMI does not distinguish fat mass from lean mass. Body circumference and the ratio of waist circumference to hip circumference are often used because of the interest in excess visceral fat as a potential risk factor for chronic diseases; neither provides a precise estimate of visceral fat. Skinfold thickness can provide a reasonable assessment of body fat, especially when taken at multiple site. However, skinfold is subject to considerable variation between observers, does not provide information on abdominal and intramuscular fat, and is generally inferior to simple measurements of weight and height. Bioimpedance is based on the principle that lean mass conducts current better than fat mass, and a measurement of the resistance to a weak current applied across the extremities provides an estimate of fat. Bioimpedance does not predict biologic outcomes more accurately than do simple anthropometric measurements.

The selection of a cutoff point for guideline for weight involves the balancing of sensitivity and specificity. A maximally sensitive guideline to identify persons at risk from excess body fat would use an upper limit for BMI of 22 or 23, but many persons would be considered to have false positive results according to this criterion. Conversely it the upper limit were set at 27, many persons with a lower BMI would not be classified as overweight but would later have conditions that result from excess body fat. The United States sets the BMI cutoff point at 25.

Like the recommendations for a BMI cutoff point, choosing a point on the waist circumference continuum involves a trade-off of sensitivity and specificity. Ideally guidelines for waist circumference should be adjusted for overall body size, in particular for height.

Folate Deficiency

Author:	**O'Broin SD, Gunter EW**
Title:	**Screening of folate status with use of dried blood spots on filter paper**
Source:	**American Journal of Clinical Nutrition 1999;70:359-67**

The objective of this study was to develop and evaluate an optimal method for the dried-blood sample (DBS) folate analysis and to assess DBS folate stability. Finger-stick blood was collected and placed on special filter paper, dried and later eluted for testing. Hemoglobin folate values were calculated from DBS eluate folate and hemoglobin concentrations. DBS folate assay reproducibility was acceptable bot from finger-stick DBS and conventional venous methods. DBS folate has potential as an inexpensive and practical way of fulfilling the escalating demand for blood folate screening.

Iron Deficiency

Ahluwalia N. Diagnostic utility of serum transferrin receptors measurements in assessing iron status. Nutrition Reviews 1998;56(5):133-141

Akesson A, Bjellerup P, Vahter M. Evaluation of kits for measurement of the soluble transferrin receptor. Scandanavian Journal of Clinical Laboratory Investigation 1999;59:77-82

Beghetti M, Mermillod B, Halperin DS. Blue Sclerae: A sign of iron deficiency anemia in children? Pediatrics 1993;91(6):1195-1196

Khusun H, Yip R, Schultink W, *et al*. World Health Organization hemoglobin cut-off points for the detection of anemia are valid for an Indonesian population. Journal of Nutrition 1999;129(9):1669-1674

Kuizon MD, Madriaga JR, Desnacido JA, *et al*. Iron status of filipino infants and preschoolers using plasma ferritin and transferrin receptor levels. Southeast Asian Journal of Tropical Medicine and Public Health 1996;27(2):343-349

Lewis SM, Stott GJ, Wynn KJ. An inexpensive and reliable new haemoglobin colour scale for assessing anaemia. Journal of Clinical Pathology 1998;51:21-24

Morris SS, Ruel MT, Cohen RJ, *et al.* Precision, accuracy and reliability of hemoglobin assessment with use of capillary blood. American Journal of Clinical Nutrition 1999;69:1243-8

Münster M, Lewis SM, Erasmus LK *et al.* Field evaluation of a novel haemoglobin measuring device designed for use in a rural setting. South African Journal of Medicine 1997;87(11):1522-26

Pistorius LR, Funk M, Pattinson RC, *et al.* Screening for anemia in pregnancy with copper sulfate densitometry. International Journal of Gynecology and Obstetrics 1996;52:33-36

Stoltzfus RJ, Edward-Raj A, Dreyfus ML, *et al.* Clinical pallor is useful to detect severe anemia in populations where anemia is prevalent and severe. Clinical Journal of Nutrition 1999;129(9):1675-1681

Van den Broek NR, Letsky EA, White SA, *et al*. Iron status in pregnant women: which measurements are valid? British Journal of Haematology 1998;103:817-824

Van den Broek NR, Ntonya C, Mhango E, *et al.* Diagnosing anemia in pregnancy in rural clinics: assessing the potential of the haemaglobin color scale. Bulletin of the World Health Organization 1999;77(1):15-21

Wharton BA. Iron deficiency in children: detection and prevention. British Journal of Haematology 1999;106:270-280

Author:	**Ahluwalia N**
Title:	**Diagnostic utility of serum transferrin receptors measurements in assessing iron status**
Source:	**Nutrition Reviews 1998;56(5):133-141**

This article provides background information on the diagnostic value of serum transferrin receptors (TfR) measurement in assessing iron status. Unlike conventional laboratory tests of iron status, serum TfR are unaffected by underlying acute or chronic infection. Therefore, serum TfR measurement is particularly promising for evaluation of iron status when iron deficiency is simultaneously present with overt or subclinical infection or inflammation – a scenario often seen in persons living in developing countries. Serum TfR determination is a specific test of iron status, which is reliable, and only a small amount of blood is required for its accurate determination. These sensitivity, specificity and reliability characteristics enable it to enhance confidence in iron status assessment in complex situations with the standard repertoire of laboratory tests.

Author:	**Akesson A, Bjellerup P, Vahter M**
Title:	**Evaluation of kits for measurement of the soluble transferrin receptor**
Source:	**Scandanavian Journal of Clinical Laboratory Investigation 1999;59:77-82**

Three commercially available kits for the determination of the soluble serum transferrin receptor (sTfR), R & D Systems (UK), Ramco Laboratories (USA) and Orion (Finland) were compared with respect to practicability, comparability and ability to discriminate between iron deficient and non-iron deficient subjects. Serum samples representing different concentrations of sTfR were tested. The three kits involved virtually the same laboratory procedures except for a predilution step for Ramco. Both the absolute amounts and the units differed among the kits, emphasizing the need for internationally accepted reference material and comparable units. The correlation coefficients were 0.97 (Ramco and R&D), 0.769 (R&D and Orion) and 0.759 (Ramco and Orion), indicating a lower comparability for Orion compared to the other two kits. The differences between the kits may be attributed to uncertainties in the reference intervals and to variations in kit format. This may have implications for studies of the usefulness of sTfR as a marker for iron deficiency.

Author:	**Beghetti M, Mermillod B, Halperin DS**
Title:	**Blue Sclerae: A sign of iron deficiency anemia in children?**
Source:	**Pediatrics 1993;91(6):1195-1196**

This study examines the validity of the association between blue sclera and iron deficiency anemia (IDA) and assesses the value of this clinical sign in a pediatric population. Laboratory screening tests such as blood smear examination and measurements of hemoglobin, serum iron, transferrin, and ferritin concentrations are invasive and too costly to be applied on a large scale. The sensitivity of blue sclerae as a sign of IDA was 56% and its specificity was 73%. In younger patients, the sensitivity was higher, but specificity was poor. Overall, the positive predictive value of blue sclerae as a sign of IDA was 28%, and its negative predictive value was 90%. This study confirms the association of IDA and blue sclera in children. However it is concluded that blue sclera do not constitute a reliable indicator of IDA in young children.

Author:	**Khusun H, Yip R, Schultink W, *et al*.**
Title:	**World Health Organization hemoglobin cut-off points for the detection of anemia are valid for an Indonesian population**
Source:	**Journal of Nutrition 1999;129(9):1669-1674**

The study was designed to determine whether population-specific hemoglobin (Hgb) cut-off values for detection of iron-deficiency are needed for Indonesia by comparing the Hgb distribution of healthy young Indonesians with that of an American population. Hgb, iron-biochemistry tests and key infection indicators that can influence iron metabolism were analyzed. The Hgb distribution based on individuals without evidence of clear iron deficiency and infectious process were compared with the National Health and Nutrition Survey (NHANES) II population of the United States. The mean Hgb of Indonesian males was similar to the American reference population at 152 g/L with comparable Hgb distribution. For females it was 2 g/L lower than that of the American reference population. Based on the finding of Hgb distribution of men and the test performance of anemia (Hgb, 120 g/L) for detecting iron deficiency for women, it is concluded that there is no need to develop different cut-off points for anemia as a tool for iron-deficiency screening in this population.

Author:	**Kuizon MD, Madriaga JR, Desnacido JA, *et al*.**
Title:	**Iron status of filipino infants and preschoolers using plasma ferritin and transferrin receptor levels**
Source:	**Southeast Asian Journal of Tropical Medicine and Public Health 1996;27(2):343-349**

This report presents the findings of a case study to determine the proportion of iron deficient subjects in a group of Filipino infants and children using plasma ferritin (PF), hemoglobin (Hgb) and transferrin receptor (TR). The occurrence of anemia in the presence of elevated TR without any decrease in PF values suggest that the diagnostic ability of PF could be limited in the presence of infections. Therefore, future studies should include biochemical tests such as C-reactive proteins (CRP) to determine the extent of association between anemia and infections.

Author:	**Lewis SM, Stott GJ, Wynn KJ**
Title:	**An inexpensive and reliable new haemoglobin colour scale for assessing anaemia**
Source:	**Journal of Clinical Pathology 1998;51:21-24**

This paper describes a new inexpensive method (the WHO Colour Scale) for estimating hemoglobin concentration from a drop of blood. The color scale method is intended as a simple to use clinical resource at a cost of about $1/10^{th}$ that for traditional photometric analysis. This paper briefly reviews studies that were conducted to assess the feasibility, reliability and usefulness of the color scale method. In one study results of the color scale were compared with a standard laboratory method of measuring hemoglobin. The slight discrepancy of results was mainly due to avoidable errors made by personnel. Laboratory based validation and preliminary feasibility studies show that the device has strong potential to be used in developing countries for primary health centers, obstetrical management, pediatric clinics, malaria and hookworm control program, blood transfusion donor selection and epidemiological surveys of anemia.

Author:	**Morris SS, Ruel MT, Cohen RJ, *et al.***
Title:	**Precision, accuracy and reliability of hemoglobin assessment with use of capillary blood**
Source:	**American Journal of Clinical Nutrition 1999;69:1243-8**

This study examined the reliability of the portable hemoglobinometer (PHM) system with use of capillary blood and the implications of errors of the magnitude found for the classification of anemia status in individuals and population groups. The precision and accuracy of the method with use of venous blood were also tested. Three empirical data sets (two from Honduras and one from Bangladesh) were used to measure reliability, precision, and accuracy of the PHM system. Simulation data were used to assess the implications of errors for screening individuals for anemia and to estimate anemia prevalence. The simulation data showed that errors of the magnitude found due to unreliability can lead to misclassification of anemia status in individuals and small biases in anemia prevalence estimates. It is recommended to replicate sampling to reduce the influence of unreliability in the use of the PHM system with capillary blood.

Author:	**Münster M, Lewis SM, Erasmus LK *et al.***
Title:	**Field evaluation of a novel haemoglobin measuring device designed for use in a rural setting**
Source:	**South African Journal of Medicine 1997;87(11):1522-26**

The objective of this study was to evaluate the color scale method when used by non-trained personnel in rural settings to estimate hemoglobin concentrations. Hemoglobin value estimates obtained with the color scale method were compared with the actual hemoglobin concentration measured by the H*3 Bayer-Technicon automated blood analyzer. Although individuals varied in their ability to use the color scale, its performance was generally very good when measured against automated haemoglobinometry, as determined by bias and regression analysis, as measured by sensitivity, specificity, positive and negative predictive values. The sensitivity and specificity for the detection of anemia of 89% and 84%, respectively suggest that this device would be suitable for large-scale anemia screening.

Author:	**Pistorius LR, Funk M, Pattinson RC, *et al.***
Title:	**Screening for anemia in pregnancy with copper sulfate densitometry**
Source:	**International Journal of Gynecology and Obstetrics 1996;52:33-36**

The copper sulfate method of screening for anemia was evaluated to determine its accuracy in antenatal patients. In an antenatal clinic in a tertiary referral center in South Africa 100 antenatal patients were prospectively tested for anemia by Coulter hemoglobin analysis in comparison with the copper sulfate test. The respective accuracy and costs of the tests were evaluated. Once initial technical difficulties had been overcome, the copper sulfate test proved accurate in detecting a hemoglobin level < 10 g% in pregnancy (sensitivity 94% and specificity 95%, positive predictive and negative predictive value of 80 and 99%, respectively.) The cost of the copper sulfate test is estimated to be less than 0.3% that of the Coulter test. It is concluded that the copper sulfate test is accurate and inexpensive and can be recommended for the screening for anemia in pregnancy.

Author:	**Stoltzfus RJ, Edward-Raj A, Dreyfus ML, *et al.***
Title:	**Clinical pallor is useful to detect severe anemia in populations where anemia is prevalent and severe**
Source:	**Clinical Journal of Nutrition 1999;129(9):1675-1681**

To investigate the accuracy and usefulness of clinical pallor to detect severe anemia, hemoglobin (Hgb) levels were measured and compared to the assessment results of clinical pallor of the conjunctiva, palm and nail beds. The study was carried out in five population samples in Zanzibar and Nepal, where severe anemia is common. The prevalence of pallor did not correspond to the prevalence of anemia or severe anemia in the groups studied. However, in all studies pallor at each anatomical site was associated with a significantly lower Hgb concentration. Overall estimates for sensitivity and specificity were 50 and 92% respectively. Although imperfect, use of pallor to screen and treat severe anemia by primary care providers is feasible and worthwhile where severe anemia is common and in resource limited settings where hematocrit and Hgb cannot be directly determined.

Author:	**Van den Broek NR, Letsky EA, White SA, *et al*.**
Title:	**Iron status in pregnant women: which measurements are valid?**
Source:	**British Journal of Haematology 1998;103:817-824**

This study examines the diagnostic accuracy of iron parameters including mean cellular volume (MCV) and its saturation, zinc protoporphyrin (ZPP), ferritin and serum transferrin receptor (TfR) for the assessment of iron status in a population anemic pregnant women in Malawi. Stained bone marrow aspirates were used as the standard for comparison. Results show that for the purpose of screening, serum ferritin is the best single indicator of storage iron, provided a cut-off point of 30 μg/L is used. A number of other commonly used parameters of iron status were shown to have limited diagnostic accuracy.

Author:	**Van den Broek NR, Ntonya C, Mhango E, *et al.***
Title:	**Diagnosing anemia in pregnancy in rural clinics: assessing the potential of the haemaglobin color scale**
Source:	**Bulletin of the World Health Organization 1999;77(1):15-21**

This study was conducted to determine the value of a color scale for assessing hemoglobin (Hgb) as a screening method for anemia in rural antenatal clinics when used by local staff. The results were compared with values estimated for the same individuals by clinical examination of the conjunctiva and by measurements of Hgb using a battery operated Hemo-Cue machine. As a standard for comparison Hgb measurements were obtained on venous blood samples using a Coulter Counter. Sensitivity using the color scale was consistently better than for conjunctival inspection alone and interobserver agreement and agreement with Coulter counter measurements was good. The Hemoglobin Color Scale is simple to use well accepted, cheap and gives immediate results. It shows considerable potential for use in screening for anemia in antenatal clinics in settings where resources are limited.

Author:	**Wharton BA**
Title:	**Iron deficiency in children: detection and prevention**
Source:	**British Journal of Haematology 1999;106:270-280**

This paper reviews detection and prevention of iron deficiency anemia (IDA) referring mainly to studies published in the last five years. Possible risk factors for IDA are pointed out, such as age of a child, dietary history and socio-economic background. Methods of diagnosis are presented, including measurement of Hemoglobin concentration alone and Hemoglobin and red blood cell indices. As preventative measures against IDA screening is proposed at various ages, for example at birth, during the suckling period (0-4 months) and in adolescents. Possible ways of achieving a reduction in IDA such as health education and fiscal measures are reviewed.

Iodine Deficiency

May SL, May WA, Bourdoux PP, Pino S, *et al.* Validation of a simple, manual urinary iodine method for estimating the prevalence of iodine-deficiency disorders, and interlaboratory comparison with other methods. American Journal of Clinical Nutrition1997;65(5):1441-5

Rendl J, Bier D, Groh T, Reiners C. Rapid urinary iodine test. Journal of Clinical Endocrinology and Metabolism 1998;83(3):1007-1012

Author:	**May SL, May WA, Bourdoux PP, Pino S,et al.**
Title:	**Validation of a simple, manual urinary iodine method for estimating the prevalence of iodine-deficiency disorders, and interlaboratory comparison with other methods**
Source:	**American Journal of Clinical Nutrition1997;65(5):1441-5**

This paper describes steps performed to validate simple, inexpensive, manual urinary iodine acid digestion method, and compare the results using this method with those of other urinary iodine methods. There was a high correlation between all methods and the interpretation of the results was consistent. The favorable comparison with other urinary iodine methods, including more sophisticated and automated methods, is particularly encouraging and indicates that it would be suitable for use in public health laboratories as part of national IDD monitoring and assessment programs.

Author:	**Rendl J, Bier D, Groh T, Reiners C**
Title:	**Rapid urinary iodine test**
Source:	**Journal of Clinical Endocrinology and Metabolism 1998;83(3):1007-1012**

The authors assessed a rapid urinary iodine test. Interpretation of results is based on a color-scale. The test was performed on 370 patients referred to a clinic in Germany for thyroid examination. It was found that environmental temperatures had no impact on the materials, reagents or results of the test. Rapid urine test results compared to those obtained using a reference test (high-performance liquid chromatography- HPLC) showed very good agreement, when testing both low and high urine iodide concentrations. This test allows on-site monitoring of iodine deficiency under conditions of heat and storage usually found in developing countries.

Vitamin A Deficiency

Chowdhury S, Kumar R, Ganguly NK, *et al.* Conjunctival impression cytology with transfer (CICT) to detect pre-clinical vitamin A deficiency among slum children in India. British Journal of Nutrition 1996;5:785-790

Makdani D, Sowell AL, Nelson D, Apgar J, *et al.* Comparison of Methods of Assessing Vitamin A status in children. Journal of the American College of Nutrition 1996;15(5):339-349

Tanumihardjo A, Cheng JC, Permaesih D, *et al.* Refinement of the modified-reliable-dose-response test as a method for assessing vitamin A status in a field setting: experience with Indonesian children. Journal of Clinical Nutrition 1996;64:966-71

Underwood B. From research to global reality: the micronutrient story. Journal of Nutrition 1998;128(2):145-51

Author:	**Chowdhury S, Kumar R, Ganguly NK, *et al.***
Title:	**Conjunctival impression cytology with transfer (CICT) to detect pre-clinical vitamin A deficiency among slum children in India**
Source:	**British Journal of Nutrition 1996;5:785-790**

The study described here was designed to examine the suitability of CICT, a simple technique for estimating the prevalence of pre-clinical vitamin A deficiency. The study was conducted under field conditions in India where vitamin A deficiency is a serious public health problem. The aims of the study were to test the feasibility of using CICT in the field, to compare the sensitivity, specificity and positive predictive value (PPV) of CICT with plasma retinal concentrations and to describe the vitamin A status of a poor slum community. At a plasma concentration of <0.70 :mol/l measured by the HPLC the sensitivity, specificity and PPV of CICT were 90.59%, 100% and 100%, respectively. Compared with conventional conjunctival impression cytology, CICT is less time consuming, cheaper, and comparable in validity. It is thus more suitable than the conventional method for mass screening.

Author:	**Makdani D, Sowell AL, Nelson D, Apgar J, *et al.***
Title:	**Comparison of Methods of Assessing Vitamin A status in Children**
Source:	**Journal of the American College of Nutrition 1996;15(5):339-349**

The purpose of this study was to determine the proportion of children at risk of vitamin A deficiency in Belize, Central America. The data provide an opportunity to compare results of three methods of assessing vitamin A status in a population, which was not malnourished. The three methods of assessing vitamin A status were: Reliable-dose-response (RDR) test, fasting serum retinol concentration, and conjunctival impression cytology (CIC). Retinol binding protein (RBP), serum retinyl esters and serum zinc concentrations were also determined. The three indices of vitamin A status did not identify the same individuals nor indicate the same percentage of the population to be at risk for vitamin A deficiency.

Author:	**Tanumihardjo A, Cheng JC, Permaesih D, *et al.***
Title:	**Refinement of the modified-reliable-dose-response test as a method for assessing vitamin A status in a field setting: experience with Indonesian children**
Source:	**Journal of Clinical Nutrition 1996;64:966-71**

The Reliable-Dose-Response (RDR) and the modified-reliable-dose-response (MRDR) tests are based on the observation that in vitamin A deficient individuals, retinal-binding-protein (RBP) accumulates in the liver. When a small challenge of vitamin A is given, RBP-bound vitamin A is rapidly released into the blood. The advantage of MRDR over RDR is that only one blood sample is needed for MRDR. This study assesses the vitamin A status of children from a suburban area in Indonesia using the MRDR. The authors conclude that the MRDR test is a valuable tool for assessing the vitamin A statuses of groups at risk of having inadequate vitamin A nutriture. Among vitamin assessment tools the MRDR test offers researchers and community nutritionists more information than serum retinal curves alone. Unlike many indexes of vitamin A status is useful for both diagnosing vitamin A inadequacy in individuals as well as in defining the vitamin A status of populations.

Author:	**Underwood B.**
Title:	**From research to global reality: the micronutrient story.**
Source:	**Journal of Nutrition 1998; 128(2):145-51**

The author strongly promotes nutrition-related research and community-oriented scientific nutrition research and provides a brief overview of research achievements. Field studies demonstrated that iodine-deficient populations responded to simple iodine supplementation by eliminating the incidence of cretinism and reducing the prevalence and size of goiter. Community-based studies of vitamin A deficient child populations documented response to vitamin A supplementation by decreased prevalence of eye signs and even by an average 23% reduced mortality risk. Sound epidemiological research provided the information needed to reposition the image of micronutrients into one with obvious political appeal because human, economic and social consequences could be averted by low-cost available intervention programs.