# A needs assessment for an advanced course in nutrition at Ahfad University College for Women, Sudan

by

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# INTRODUCTION

## Statement of the Problem

Malnutrition is a common problem in the Sudan. The nutritional status of the population is of great concern to governmental and non-governmental agencies in the Sudan. According to a nutrition survey conducted in the Sudan, overall caloric and protein intakes were determined to be adequate, even though 50% of preschool children were malnourished (Wessly, 1984). These data led researchers to conclude that nonavailability of food at the family level was not the main cause of malnutrition. Instead, infections, diarrheal diseases, ignorance, taboos, and traditional practices related to feeding were considered to be the main etiological factors leading to malnutrition in children and pregnant women. These conditions point to the fact that more work needs to be done in nutrition education.

Ahfad University College for Women (AUCW) is one of the institutions that addresses the education of women for leadership and effective change. The School of Family Sciences at AUCW has offered a nutrition program since 1966. The main goal of this program is to improve the nutritional status of the Sudanese communities by educating and training female students to provide health and nutrition services to the local communities. This nutrition program has been undergoing a continuous evaluation process to cope with the present nutritional needs in the Sudan. Evaluators have recommended that additional courses in nutrition should be implemented in the

program at AUCW (Terry, 1987). However, no study has been conducted to determine the exact nature and content of the courses that are needed.

This study is designed to determine the content needed for an advanced nutrition course during the fourth level at AUCW by measuring the cognitive knowledge of nutrition of students who have completed the existing third level nutrition course.

In conclusion, appropriate programs in nutrition are needed to further address the malnutrition problems in the Sudan. Assessing the cognitive nutrition knowledge needed by the students at AUCW will help to determine the content needed for an advanced course in nutrition. Training students at AUCW will provide qualified agents who can help eradicate malnutrition problems.

## Purposes of the Study

The main objectives of this study were to:

1. construct a cognitive instrument to measure the nutrition knowledge of third-year students participating in an introductory nutrition course.
2. evaluate the data obtained from AUCW students to determine areas of nutrition content in which they lack information.
3. develop a curriculum outline for a fourth-year advanced course in nutrition based on the content analysis.

## Definition of Terms

1. Needs assessment: Diagnostic process to look at a given set of needs and identify those that are the target needs (Ulschak, 1983).
2. Advanced course in nutrition: Nutrition course to be developed for the fourth-year level at AUCW. The course will be composed of more advanced nutrition knowledge than the introductory course at the third year level.
3. Malnutrition: Insufficient and poor nutrition that is caused by lack of one or more essential nutrients (Gifft, Washbon and Harrison, 1972, p. 117).

## Assumptions

1. Students commencing their fourth year at AUCW will complete the cognitive instrument to the best of their abilities although their participation will not affect their grade for the course.
2. The students will have retained a sufficient amount of knowledge from the third year course in nutrition to provide the information needed to plan the fourth-year course.
3. The cognitive instrument will provide the information needed to identify content areas to be included in the fourth year course.
4. Providing a fourth year advanced nutrition course will

improve the program at AUCW for preparing the students to better cope with community needs.

## Limitations

1. The sample will be students beginning the fourth-year level at AUCW who have completed the introductory third-year nutrition course.
2. The nutrition information covered by the test items will be limited to the content of the introductory course in nutrition at the third-year level.
3. Inferential data will be limited by the degree to which the cognitive instrument measures the third-year nutrition course objectives.

Other chapters in this study are composed of literature review, methodology, results and discussion, and summary and recommendations.

# LITERATURE REVIEW

## The Sudan

### Background

The Sudan comprises some 1,000,000 square miles. It is the largest country in Africa and the Arab world, bordered by eight countries: Egypt, Libya, Central African Republic, Chad, Zaire, Uganda, Kenya, and Ethiopia.

The annual rainfall varies from less than 50 mm in the desert to about 500 mm in subtropical areas. In every ten years, two years are characterized by drought, based on the annual rainfall (Abu-Shaikha, 1982).

The population is estimated at around 22 million. Urban population constitutes 24% of the total population. The Sudan is basically an agricultural country. Agriculture is responsible for 40% of the gross domestic product and nearly 90% of the exports. Over 80% of the population is dependent upon agriculture which forms the basis of the economy both at the traditional subsistence level and the cash production level. The agricultural share in the economy is declining in recent years as a result of the inadequate performance of the sector (Wessly, 1984).

### Food and nutrition

Seventy percent of the labor force in the Sudan is working in the agriculture sector. Two hundred million miles of land are suitable for cultivation but only ten percent of the land is actually

being cultivated. Sixty percent of the irrigation systems depend on rain and that makes it difficult to predict the amount and time of rainfall which sometimes leads to drought and famines.

Studies have shown that the amount of food being produced in the Sudan is adequate for the population's need. However, the food shortages that have occurred in some areas of the country have been attributed to the following:

1. Training: There is a massive need for trained labor to secure food production.
2. Roads: Bad roads for transportation and lack of food manufacturers are hindering developing projects.
3. Storage: Lack of food storage leads to damage of at least 60% of the food produced.
4. Health and nutrition status: Poor health and nutritional status of the population affects food production.
5. Migration: Increased migration from rural to urban sectors has placed a burden on the urban food supply. In addition, food production has decreased in the rural areas.
6. Population: In some areas in the Sudan food production is not adequate for increasing population (population growth is 2.8%). (Wessly, 1984)

## Nutritional Status of the Population

Nutritional status of any population is always an indicator of the health status because good health cannot be achieved without

proper nutrition. The mortality rate among infants and children up to four years is commonly used as an indicator for the health and nutrition problems of communities (mortality rate for infants and children up to four years in the Sudan is 112/1000). Infants and children are often affected since their requirements for energy are higher than adults because they are growing. At age six months, the growing infant has doubled his birth weight and at age two years weight is expected to increase by 100% and height to increase by 30% (Mohamed, 1987).

Malnutrition can result from a combination of different factors such as poverty (socio-economic), food availability, cultural background, availability of health services and environmental sanitation, infectious diseases and lack of general education.

Sudan as a developing country is faced mainly by four nutrition problems: 1) protein-energy malnutrition (PEM), 2) Vitamin A deficiency, 3) endemic goiter, and 4) nutritional anemias (Mohamed, 1987). PEM in the Sudan is one of the main problems and results in many diseases and deaths, mainly among children. PEM is a term used commonly to describe all degrees (mild, moderate and severe) and clinical types (marasmus. marasmic-kwashiorkor and kwashiorkor) of the most widespread nutritional disorders of childhood in developing countries (Mclaren, 1981). The disease syndrome is variable since the degree of both energy and protein malnutrition as well as other nutrients will influence the biochemical and clinical changes (Pike & Brown, 1984). A total reduction in the intake of all nutrients

amounting to complete starvation in the most severe form. The highest priority is given by the body to the need to meet its energy requirements. If these cannot be met from dietary sources, the body's stores of glycogen and fat are drawn upon. The protein of the lean body mass is also catabolized and consequent wasting of organs and muscles results (Mclaren, 1981).

In children, severe marasmus, or chronic starvation, is characterized by growth retardation, loss of body fat and muscle wasting. Kwashiorkor is characterized by wasting, fatty liver, edema, changing in texture and pigmentation of hair and skin, gastrointestinal disturbances and diarrhea which result in loss of electrolytes (Pike & Brown, 1984). In some population studies the magnitude of the problem is very severe. One study indicated that among 2,100 cases examined in Wadmedini town in 1966-1967, one third (700) were diagnosed to have marasmus and kwashiorkor in a ratio of 4:3 at age 6 - 36 months (Mohamed, 1987). The results of another survey conducted in 1969 at Haj Yousif Village indicated that among 304 infants and children up to four years, 3.9% were suffering from marasmus and 2.6% from kwashiorkor (Bushara, 1973). In a comparison study between 1976 and 1979 to assess the nutritional status of infants and children up to age five in Khartoum, the national capital, before and after distribution of food items and nutrition education, results showed that educational programs have positive effects. The percentage of children suffering from third degree malnutrition decreased from 0.1 percent to 0 percent. The

number of those who suffered from second degree malnutrition decreased from 19.8% to 3.0% and those who suffered from first degree malnutrition increased from 45.1% to 72.0% (Mohamed, 1987).

More recent studies indicate that protein-energy malnutrition continues to be a problem among certain groups of children. In 1986, it was reported from North Kordufan that 64.95% of the children being surveyed were well nourished, 30.55% had mild malnutrition, 3.55% moderate malnutrition, and 0.95% had severe malnutrition. Mortality rates were reported to be 112/1000 (Mohamed, 1987).

Vitamin A deficiency affects the eyes externally by disrupting the epithelia of the cornea (keratomalacia), and internally by lowering sensitivity of the retina to light (night blindness). A sign of A-vitaminosis was found among 85% of the cases studied in the Gezira area in 1960. In 1977, 3.9% of the primary school children in the Red Sea area were found to have a bitot spot while 4.18% had night blindness. In 1978, a survey conducted in the Gezira province showed that out of 3,740 children examined, 1.9% had xerosis and bitot spots (Mohamed, 1987).

All of the above surveys were conducted before the occurrence of the last famine and drought in the Sudan which increased the problem of hypovitaminosis A to a level of public health significance in many regions of the country such as Darfour, Khartoum, Kordofan, and the eastern region of the Sudan. Among solutions recommended to eradicate the problem were nutrition education and public health programs (Mohamed, 1987).

Endemic goiter is another common problem in the Sudan. Kambal (1973) surveyed about 43 villages and towns in Darfour province and reported that 80% of the people who lived around Kas which lies at the foot of the volcanic range of Jebal Marra had goiter; the incidence was 63% among females and 52% among males. A recent study conducted in Nuba Mountain, Southern Kordofan in 1986, reported that 26.4% of the cases studied in the Mirieb area and 27.3% of the cases studied in Abukershula had goiter (Mohamed, 1987).

Nutritional anemias are another common health problem in the Sudan, especially among children, and pregnant and lactating women. Iron deficiency anemia is highly prevalent among pregnant women and children. A survey conducted in ELKhalala showed about 13% of school children having this deficiency (Abu-Shaikha, 1982).

A recent study (1987) was conducted among 11,000 mothers and their 16,200 children under age of five years to determine the nutritional status of children throughout the six northern regions of the Sudan. The overall findings indicated that Sudanese children were thinner than those used for the National Center for Health Statistics (NCHS) standards. Under-nutrition is wide spread in the northern Sudan compared with the international reference standards (one standard deviation below the reference level). Generally among adequately nourished populations, one in forty children would be moderately undernourished and one in two hundred severely so. For Sudan, the comparable figures were one in eight and one in seventy-one, respectively (Sudan emergency and recovery information and

surveillance system SERISS #4, 1987).

Compared with results from SERISS January - March 1986, nutritional status deteriorated in all provinces except Khartoum where it improved and south Darfur which showed no change (SERISS #4, 1987). The same study showed that there is a statistically significant association between parental literacy status and nutritional status. The children who have one literate parent are thinner than those who have two literate parents. Also, mother's education contributed to better nutritional status of children as measured by years of schooling of mothers.

Governmental and Nongovernmental Health and Nutrition Services

Health services

Health services expanded rapidly in the first half of the 1970s (Abu-Shaikha, 1982). The government established many hospitals, medical centers (small hospitals), dressing stations (Primary Health Care Services; PHCS), and dispensaries. People were very supportive to the extent that six million Sudanese pounds were spent in self help health projects at that time.

The number of hospitals increased from 133 in 1975 to 158 in 1980/81, and the number of health centers also increased from 144 in 1975 to 229 in 1980/81. Although these numbers increased, the fact remained that rural areas were suffering from a shortage of health services. A simpler PHCS unit serves a population of about 4,000. The dispensary supervises five simple primary health care units so

that a primary health care complex serves a population of 24,000. The distance between the dispensary and the PHCS unit is usually 10 - 20 miles (Abu-Shaikha, 1982). In 1980/1981 there were 1619 Dressing Stations and 1095 PHCS units. The health services provided in these PHCS units and complexes are mainly curative and provide far from adequate coverage of the rural areas. Inadequate roads and means of transportation are hindering reasonable access to health services in most areas. Almost all PHCS units and complexes lack the services of nutritionists and dietitians (Abu-Shaikha, 1982).

In 1980/1981 the number of doctors in all specializations was 2,122 with a ratio of 11.6 doctors per 100,000 Sudanese. There were 44.4 doctors per 100,000 Sudanese for the urban population while only 1.1 doctors/100,000 were available for the rural population (Abu-Shaikha, 1982).

Use of health facilities

A recent study done in 1987 showed that for all illnesses except measles, treatment was most frequently given by medical assistants, health-visitors, and nurses. Children with measles tend to be treated in more traditional ways through using traditional healers, family members or others. For treatment of diarrhea and vomiting, doctors and community health workers were ranked second and third as treaters. For respiratory tract infections and fevers, mothers were most likely to purchase drugs without taking the child to see the doctor. In rural and nomadic areas, the lack of doctors and pharmacies, and the lack of education are the main reasons for not

treating sick children. A large number of the children were seen by traditional healers. The study also showed that among six illnesses investigated, 38% of the children had diarrhea, 39% experienced vomiting, 23% had measles, 42% had respiratory tract infections, 40% had fevers and 64% had night blindness which was not treated (SERISS. #4, 1987).

Nutrition services

The most direct way of making progress toward eradicating the problems of malnutrition is through specific nutrition intervention programs (FAO, 1987).

The school feeding program in the Sudan has been one of the main nutrition services in the past; however, the program is not keeping pace with the increase in the number of students. The Ministry of Education established boarding houses in many of the general secondary schools, higher secondary schools, and some universities due to difficulties of transporting students to schools. In the past when the number of students receiving education at various levels was small, the Ministry had the ability to spend money for students' education and feeding. The situation changed in the early 1960s. More students needed to be educated while the Ministry faced financial problems in fulfilling its previous obligations, especially in maintaining the boarding houses for schools. This was evident in Kassala and Darfur provinces where students did not get a well-balanced diet to give them the required energy for the classroom

(Tawfig, 1973).

To solve the problem, the Ministry of Education requested the World Food Program (WFP) to initiate the school feeding program again. For five years the WFP offered food stuffs to all students in the boarding houses of all the schools in the nine provinces of the Sudan. The students were given three prepared meals daily. The total expenditure of the project was 23,887,000 US dollars. Since the WFP project ended in 1972, no other organized program for school feeding has been implemented. That has resulted in deterioration of the nutritional status of students living in the boarding schools and many of the boarding schools were closed (Tawfig, 1973).

Other nutrition services in the country are the School Gardens and Nutrition Education Centers. Thirty of the centers in Khartoum province are run by the Ministry of Education with the aim of producing vegetables and fruits and raising poultry as means of better understanding of nutrition. The project was initiated in 1964 by training some home economics teachers in gardening, nutrition, and methods of education. Also nutrition field workers were trained to teach rural women in school localities. In 1972 - 1976 with the support of FAO and UNICEF, centers were built in other provinces. In 1978 financial support from FAO and the Federal Republic of Germany allowed two provincial centers to be established; a third one opened in 1981 (Out-of-school Population Education Project, 1982). Most of the nutrition education centers lack the presence of trained personnel due to the migration of trainers to other countries. This

affects the efficiency of these centers to train home economics teachers in nutrition education at different school levels. The Nutrition Division in the Ministry of Health is offering short-term in-service training courses in applied aspects of nutrition to various officials of the ministry through the Maternity and Child Health Centers and Nutrition Rehabilitation Centers.

## Nutrition Programs in Colleges and Universities

Nutrition programs at the college and university level are very recent in the Sudan. Nutrition programs established at the University of Khartoum in 1964 provide basic and applied nutrition which are taught independently by various instructors in the Colleges of Agriculture, Education, Medicine and Veterinary Science.

In the College of Education at Khartoum University different aspects of food and nutrition are offered within the curriculum of the Home Science Department for the degree of B.S. in Home Science and Education. The main purpose of the nutrition program is to provide qualified teachers in nutrition at the secondary and post-secondary level (Khattab, 1981).

Nutrition in relation to health is a theme of the programs offered by the College of Medicine in at least four departments: biochemistry, physiology, community medicine, and pediatrics and child care. Lack of coordination among these departments hinder the effectiveness of the nutrition program (Khattab, 1981).

Animal nutrition is the main emphasis at the Colleges of

Agriculture and Veterinary Science. In the College of Agriculture, however, a few students at the final year of the B.S. in Agriculture chose the biochemistry and food science option where a course on food and nutrition is offered. A course in human nutrition and a degree in food science and nutrition has been recommended to address the increasing need in the country for such graduates (Khattab, 1981).

At the Girl's College in Omdurman Islamic University a course in nutrition is offered in Arabic within the curriculum of Home Economics for the degree of B.S.

Ahfad University College for Women is offering a Home Sciences degree with an emphasis on nutrition. The students are expected to submit research work based on laboratory and/or field work in the area of nutrition as partial fulfillment of the degree of B.S. in Home Science. The graduates hold important positions in the Ministries of Health, and Youth and Social Affairs (Khattab, 1981).

Although several colleges and universities have been involved in nutrition education in the country, the fact remains that they all share the disadvantage of being under-staffed and thus cannot effectively fulfill a role in eradicating nutrition problems in the Sudan. An urgent need for specialized post secondary institutions and colleges for training technicians in food technology and nutrition is evident. AUCW is planning to have a major in nutrition by adding a fifth year diploma in nutrition. This will justify the need for developing advanced courses in nutrition within the curriculum of Family Science School at AUCW.

In summary, the nutritional status of the population in the Sudan has been deteriorating in the last few years (SERISS #4, 1987). There is an urgent need for cooperation of governmental and nongovernmental agencies to eradicate nutrition problems and improve nutritional status of the community. Education is one of the aspects for help in solving the nutritional problems, improving the existing nutrition education programs, and developing new programs to cope with existing nutritional needs. AUCW is one of the educational institutions that aims to educate women for leadership and change. It will have an important role in addressing the country's nutritional problems by improving the existing nutrition education program and by establishing a nutrition major to provide qualified agents in the area of food and nutrition.

# METHODOLOGY

## Research Design

This study is designed to determine the content needed for an advanced nutrition course during the fourth year at AUCW. Based on identification of the need for developing a self-administered instrument, a criterion-referenced achievement test was designed for evaluating the cognitive knowledge of students in introductory nutrition in order to identify their areas of strengths and weaknesses. A set of objectives based on the content outline for introductory nutrition was developed (Appendix A). Test items were developed to measure the degree of achievement of the objectives (Appendix B) based on a table of specification (Appendix C). The data were analyzed to determine content needed for an advanced course in nutrition.

## Instrument Development

A valid test is designed to measure the instructional objectives for a course. Content-related evidence of validity is addressed by constructing a table of specifications (Appendix C) which is a systematic procedure for obtaining a representative sample of students' achievement in each of the content areas to be measured. It relates the instructional objectives to the course content and specifies the relative emphasis to be given to each type of learning outcome (Gronlund, 1985).

The instrument for this study was a criterion-referenced

achievement test designed to measure the degree of achievement of the objectives for the introductory course based on the course's content outline. A set of twenty-one objectives that are related to the eight major concepts taught in the course were outlined (Appendix A). The eight concepts were: 1) history of nutrition, 2) body composition, 3) energy expenditure, 4) regulation of food intake, 5) nutrient composition, 6) food composition tables, 7) developmental nutrition, and 8) nutrition-related diseases. The number of objectives for each area of content depended on the importance of the content and the expectation for achievement. A one-way content outline was developed to include this information. Based on the outline of the eight concepts and related subconcepts, nutrition information from the textbook being used by the instructor at AUCW, and other related nutrition textbooks, seventy-four items were developed to measure cognitive knowledge. Objective-type format was used for true-false and multiple choice items (Appendix B). The true-false items were constructed to measure relatively simple learning outcomes (Gronlund, 1985) since eleven objectives for the course were stated at lower levels of the cognitive domain. The remainder of the objectives were measured using multiple-choice items. According to Gronlund (1985) the multiple-choice item form can measure a variety of single learning outcomes as well as more complex learning outcomes in knowledge, understanding and application areas. Results can provide feedback of students' achievement.

Content validation and item selection

The set of items was submitted to three judges from the Department of Food and Nutrition at Iowa State University for evaluation (Appendix B). They were asked to evaluate the items for accuracy of facts, clarity of wording, and appropriateness for measuring objectives (Appendix D). After the judges' evaluations, the items were revised.

Validity of the instrument

The content-related evidence of validity for this instrument is represented by the table of specifications (Appendix C). All levels of the cognitive domain for the cognitive levels are represented. The test items matched the level of difficulty specified by the instructional objectives. Clear directions, random assignment of correct answers on test items, and avoidance of clues to answers provide evidence for content validity. The length of the test was suitable for the time allocation and for covering the content.

The instrument was usable. The items were first arranged by item type and then according to concepts. Administration of the test could be done efficiently because the instrument was self-administered, the items were of objective type, and the results were easy to score and could be accurately interpreted.

A pilot test was conducted using the instrument. A group of seven Home Economics graduate students with different backgrounds and with diverse nutrition knowledge were administered the test. An item analysis for the pilot test was used for further evaluation and

subsequent revision of the test items.

## Testing

### Sample

The sample involved the total population of female students beginning the fourth year level at the School of Family Sciences at AUCW in the Sudan. Two-thirds of the class were from urban areas, mainly urban Khartoum. The remaining third was a mixture from other urban and rural areas of the Sudan and Uganda. All of the students had backgrounds in science at the high school level in addition to six semesters in chemistry, biochemistry, zoology, physiology, microbiology, botany, food-production, mathematics, physics, food chemistry and introductory nutrition at the college level.

All twenty-nine students who had taken the introductory nutrition course at the third year level were tested so as to obtain unbiased results in determining content needed for an advanced course in nutrition at the fourth year level at AUCW. The instrument (in sufficient quantities) was mailed to AUCW administration and administered to the entire group of students within one hour period. The completed instrument were air mailed back to researcher.

### Determination of the cut-off score

Decisions are made for a criterion-referenced summative test based on two categories, mastery and non-mastery. The term "mastery" is used when the subject's test score exceeds a minimum level or a given standard (Huynh, 1976). On the other hand the term "non-mastery" is used when the subject's test score is below a minimum

level or a given standard.

Determining the cut-off score for level of mastery is crucial for the evaluation process because it is the basis for the decision-making process done by evaluators. For the purpose of this study, a set of objectives was stated for a defined content. A mastery test was designed to measure the degree of achievement of the objectives. The cut-off score for this test was determined according to the method described by Cangelosi (1984). This method suggested the following steps: 1) clarification of goals to be measured by a set of objectives, 2) developing a one-way table of specification showing the weight of the set of objectives within each concept and level of cognitive domain in which each objective was stated, 3) developing a set of item specifications, 4) revision of items for content validity by a group of experts, 5) pilot testing, 6) refining the test and 7) administering the test to the target group. For each objective being stated a level of mastery achievement (difficulty) should be determined in regard to its level in the cognitive domain.

Twenty-one objectives were stated for this learning structure. For each objective a suggested level of mastery achievement was determined as follows:

| Objective | Level of cognitive domain | Number of items (N=74) | Suggested mastery achievement |
|---|---|---|---|
| 1 | C-2 | 1 | 100% |
| 2 | C-2 | 3 | 100% |
| 3 | C-2 | 1 | 100% |
| 4 | C-4 | 2 | 80% |
| 5 | C-4 | 3 | 80% |
| 6 | C-2 | 6 | 100% |
| 7 | C-3 | 13 | 90% |
| 8 | C-4 | 3 | 80% |
| 9 | C-6 | 10 | 70% |
| 10 | C-1 | 2 | 100% |
| 11 | C-1 | 1 | 100% |
| 12 | C-2 | 5 | 100% |
| 13 | C-4 | 3 | 80% |
| 14 | C-5 | 2 | 75% |
| 15 | C-6 | 2 | 70% |
| 16 | C-1 | 1 | 100% |
| 17 | C-2 | 3 | 100% |
| 18 | C-3 | 2 | 90% |
| 19 | C-4 | 5 | 80% |
| 20 | C-5 | 3 | 75% |
| 21 | C-6 | 3 | 70% |

A cut-off score was computed by using the following formula proposed by Cangelosi:

$$C = t \sum_{i=1}^{K} W_i S_i$$

Where C is the cut-off score, t is the total number of items, k is the number of objectives, $W_i$ is the weight of the ith objective, $S_i$ is the minimal success rate of the ith objective. By applying the formula, the cut-off score can be determined as follows:

$$C = 74 [(.014 \times 1) + (.041 \times 1) + (.014 \times 1) + (.03 \times .8) + (.041 \times .8) + (.081 \times 1) + (.18 \times .9) + (.041 \times 8) + (.14 \times .7) + (.03 \times 1) + (.014 \times 1) + (.07 \times 1) + (.041 \times .8) + (.03 \times .75) + (.03 \times .7) + (.014 \times 1) + (.041 \times 1) + (.03 \times .9) +$$

$$(.07 \times .8) + (.041 \times .75) + (.041 \times .7)]$$

$$C = 74 \times .8876 = 65.68$$

The cut-off score determined for this test using the Cangelosi method is 66 percent.

## Data Analysis

The criterion-referenced achievement test was scored by computer. The analysis included computing the total test reliability using the K-R-20 formula for measuring internal consistency. Additional item analysis corresponding to each objective was done to determine the degree of achievement of each objective.

## RESULTS AND DISCUSSION

The mean score for the achievement test was 43.7; the median was 43 and the mode was 41. The spread of scores was 36 to 54 on a 74 item test. The standard deviation was 4.30.

### Test Reliability

Using the K-R-20 formula for measuring internal consistency, the reliability was computed to be 0.31. The narrow range of scores may have adversely affected reliability. According to Gronlund (1985), criterion-referenced mastery tests are not designed to emphasize differences among individuals and therefore we can expect a narrower range of scores than with norm-referenced tests. In mastery testing we are primarily interested in classifying students as masters or non-masters; the consistency of our mastery-nonmastery decisions should be our main concern (Gronlund, 1985).

According to the purpose of this study, results will be used for making decisions concerning areas of subject matter that need further instruction. In this case, we might be willing to use a teacher made test of relatively low reliability. Our decision will be based on the score of the total group. For a different interpretation we would need a different analysis of consistency. Reliability usually refers to the results obtained with an evaluation instrument and not to the instrument itself (reliability of test scores) (Gronlund, 1985). Normally, two forms of a test are needed for determining the reliability of an instrument. The nature of the two choices in true-

false items will increase the chance for guessing the right answer and hence lower the reliability of the test. Thirty items were constructed in the true-false format because they were measuring simple learning outcomes. On the other hand, the nature of the five responses in the multiple choice items reduced the opportunity for guessing the correct answer and would increase the reliability and validity of the test (Gronlund, 1985).

## Item Analysis

The difficulty of the test items in a criterion-referenced mastery test is determined by the nature of the specific learning tasks to be measured. At the developmental level of learning (knowledge of introductory course), test items of varying difficulty are needed for each instructional objective, because the developmental level is concerned with how much students have learned beyond the minimum essential for a course. A wide range of item difficulty is necessary to describe student performance adequately.

The ideal difficulty index for five-response multiple choice items should be about 60%. The average difficulty for the multiple-choice items on the test instrument was 51%. For true-false items the ideal difficulty index should be about 75% (Gronlund, 1985). The average difficulty index was 71.6% for test instrument. The test difficulty is reasonable. The level of difficulty for the multiple-choice items is due to the fact that they are measuring higher levels of the cognitive domain.

The nature of the true-false and multiple choice items of this

test makes it objective and easy to score and hence enhanced its usability. The test directions were found to be clearly understood which made it easy to administer. The total number of items are reliable for measuring the intended learning outcomes.

An item analysis is given in Table 1. The difficulty of the test items ranges from 0% to 100%. Thirty-three items have a difficulty level above 65% and forty-one items are below 65%. Items 14, 24, and 36 were answered correctly by all students. The three items deal with nutrition facts. The most difficult items were items 2, 43, 51, 52, 57 and 74. These items are about anthropometric measurement, fat-soluble vitamins, energy expenditure, caloric value of nutrients, essential minerals and treatment of megaloblastic anemia, respectively. One could conclude that students needed more instruction in these areas.

Forty-seven out of 176 distracters were not functioning. These distracters may not have been as well-constructed as the ones that were functioning; however, with a relatively small sample size (29), this could be another factor.

Table 1. Item Analysis

| Concept | Item no. | No. selecting distracters A | B | C | D | E | Omit | Diff.[a] |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 26* | 3 | - | - | - | | 90 |
| 2 | 2 | 27 | 2* | - | - | - | | 7 |
| | 31 | 0 | 3 | 26* | 0 | 0 | | 90 |
| | 3 | 23* | 4 | - | - | - | 2 | 82 |
| 3 | 4 | 20* | 9 | - | - | - | | 69 |
| | 32 | 15 | 6 | 1 | 5* | 1 | 1 | 18 |
| | 33 | 5 | 2 | 18* | 2 | 2 | | 62 |
| 4 | 5 | 11 | 18* | - | - | - | | 62 |
| | 6 | 25* | 3 | - | - | - | 1 | 89 |
| | 7 | 12* | 16 | - | - | - | 1 | 43 |
| 5 | 8 | 21* | 8 | - | - | - | | 72 |
| | 9 | 9 | 19* | - | - | - | | 66 |
| | 34 | 15* | 7 | 2 | 5 | 0 | | 52 |
| | 35 | 6 | 17* | 0 | 4 | 2 | | 59 |
| | 36 | 0 | 29* | 0 | 0 | 0 | | 100 |
| | 37 | 0 | 0 | 1 | 28* | 0 | | 97 |
| | 10 | 3 | 25* | - | - | - | | 86 |
| | 11 | 24* | 5 | - | - | - | | 83 |
| | 12 | 25* | 4 | - | - | - | | 86 |
| | 13 | 15 | 14* | - | - | - | | 48 |
| | 14 | 29* | 0 | - | - | - | | 100 |
| | 15 | 23* | 6 | - | - | - | | 79 |
| | 38 | 22* | 2 | 4 | 0 | 1 | | 76 |
| | 39 | 6 | 4 | 18* | 0 | 0 | 1 | 64 |
| | 40 | 16* | 2 | 4 | 3 | 3 | 1 | 57 |
| | 41 | 9 | 15* | 2 | 1 | 1 | 1 | 54 |
| | 42 | 3 | 18 | 4* | 1 | 3 | | 62 |
| | 43 | 10 | 14 | 0 | 3 | 2* | | 7 |
| | 44 | 5 | 19* | 4 | 0 | 1 | | 66 |
| | 45 | 0 | 23* | 2 | 0 | 4 | | 79 |
| | 46 | 5 | 12 | 2 | 10* | 0 | | 34 |
| | 47 | 0 | 9 | 20* | 0 | 0 | | 69 |
| | 48 | 1 | 11* | 7 | 7 | 2 | 1 | 39 |
| | 49 | 8 | 6* | 5 | 5 | 4 | 1 | 21 |
| | 50 | 1 | 7 | 3 | 12* | 4 | 2 | 44 |
| | 51 | 18 | 2 | 1* | 4 | 1 | 3 | 4 |

Note. Total N = 29.
[a]Diff. = item difficulty in percent answered correctly.
*Denotes correct answer.

Table 1. (Continued)

| Concept | Item no. | No. selecting distracters A | B | C | D | E | Omit | Diff. |
|---|---|---|---|---|---|---|---|---|
| | 52 | 14 | 2 | 7 | 2* | 2 | 2 | 7 |
| | 53 | 21* | 1 | 0 | 2 | 5 | | 72 |
| | 54 | 9* | 0 | 1 | 10 | 8 | 1 | 32 |
| | 55 | 1 | 0 | 5 | 6 | 13* | 4 | 52 |
| | 56 | 13* | 11 | 0 | 3 | 2 | | 45 |
| | 57 | 6 | 2 | 7 | 1* | 11 | 2 | 4 |
| 6 | 58 | 4 | 21* | 0 | 2 | 2 | | 72 |
| | 59 | 0 | 3 | 1 | 20* | 5 | | 69 |
| 7 | 16 | 4 | 25* | - | - | - | | 86 |
| | 17 | 18 | 11* | - | - | - | | 38 |
| | 18 | 10* | 19 | - | - | - | | 34 |
| | 19 | 22 | 7* | - | - | - | | 24 |
| | 60 | 10 | 15* | 4 | 0 | 0 | | 52 |
| | 61 | 0 | 3 | 6 | 17* | 2 | 1 | 61 |
| | 20 | 6 | 23* | - | - | - | | 79 |
| | 62 | 12* | 1 | 15 | 0 | 1 | | 41 |
| | 63 | 7 | 3 | 0 | 3 | 15* | 11 | 54 |
| | 21 | 25* | 3 | - | - | - | 1 | 89 |
| | 22 | 28* | 1 | - | - | - | | 97 |
| | 64 | 1 | 3 | 7 | 3 | 14* | 1 | 50 |
| | 65 | 6 | 0 | 2 | 4 | 17* | | 59 |
| 8 | 23 | 22* | 7 | - | - | - | | 76 |
| | 24 | 29* | 0 | - | - | - | | 100 |
| | 66 | 2 | 4 | 8 | 4* | 11 | | 14 |
| | 67 | 3 | 9 | 17* | 0 | 0 | | 59 |
| | 25 | 24* | 5 | - | - | - | | 83 |
| | 68 | 0 | 27* | 0 | 2 | 0 | | 93 |
| | 26 | 15* | 14 | - | - | - | | 52 |
| | 27 | 6 | 23* | - | - | - | | 79 |
| | 28 | 22* | 7 | - | - | - | | 76 |
| | 69 | 8 | 2 | 2 | 0 | 17* | | 59 |
| | 70 | 10 | 0 | 15* | 0 | 3 | 1 | 54 |
| | 29 | 28* | 1 | - | - | - | | 97 |
| | 30 | 17* | 12 | - | - | - | | 59 |
| | 71 | 0 | 4 | 4 | 0 | 21* | | 72 |
| | 72 | 10 | 11* | 3 | 0 | 5 | | 38 |
| | 73 | 1 | 2 | 25 | 0 | 0* | 1 | 0 |
| | 74 | 2 | 20* | 5 | 0 | 1 | 1 | 71 |

## Concept Analysis

According to the cut-off score (level of mastery) determined for this test (66%), the concepts on History of Nutrition, Food Composition Tables, and Regulation of Food Intake were mastered by at least 75% of the students (Table 2). No further instruction is needed for the three concepts. The other five concepts on Body Composition, Energy Expenditure, Nutrient Composition, Developmental Nutrition and Nutrition-related Diseases were not mastered by the students. Some objectives within each concept were not achieved and further instruction is needed to achieve those objectives. The level of difficulty and the number of test items per concept influenced the level of mastery of each objective. Understanding of the concepts on Energy Expenditure and Nutrient Composition were affected by limited instruction at the introductory course level.

Table 2. Concept analysis

| Concepts and objectives | Number of items | Mean of Difficulty Index (%) | Achieved Mastery (%) |
|---|---|---|---|
| C1. History of Nutrition | | | |
| 01. Relate the development of nutrition as a science to other related fields (C-2) | 1 | 90.0 | 90.0 |
| C2. Body composition | | | |
| 01. Identify the uses of anthropometric measurements (C-2) | 3 | 59.6 | 59.6 |
| C3. Energy Expenditure | | | |
| 01. Estimate energy expenditure using different methods (C-2) | 1 | 69.0 | 69.0 |
| 02. Distinguish among different activities involved in energy needs for basal metabolism (C-4) | 2 | 49.7 | 62.0 |
| C4. Regulation of Food Intake | | | |
| 01. Identify different control mechanisms associated with regulation of food intake (C-4) | 3 | 64.6 | 80.0 |
| C5. Nutrient Composition | | | |
| 01. Distinguish among nutrient containing foods (C-2) | 6 | 74.3 | 74.0 |
| 02. Predict the properties and physiological role of essential nutrients (C-3) | 13 | 66.5 | 73.7 |
| 03. Categorize different sources of dietary nutrients according to their caloric and biological value of major nutrients (C-4) | 3 | 60.0 | 75.0 |
| 04. Interpret the caloric and biological value of major nutrients (C-6) | 10 | 32.0 | 46.0 |
| C6. Food composition Tables | | | |
| 01. Identify the major nutrients in each food group (C-1) | 2 | 70.5 | 70.5 |

Table 2. (Continued)

| Concepts and Objectives | Number of Items | Mean of Difficulty Index (%) | Achieved Mastery (%) |
|---|---|---|---|
| C7. Developmental Nutrition | | | |
| 01. Describe nutrient requirements during life cycle (C-1) | 1 | 86.0 | 86.0 |
| 02. Predict the essential nutrients required for different physiological aspects of life (C-2) | 5 | 43.8 | 43.8 |
| 03. Identify necessary dietary food during pregnancy (C-4) | 3 | 58.0 | 72.0 |
| 04. Explain the influence of breast-feeding on infant nutrition (C-5) | 2 | 93.0 | 93.0 |
| 05. Justify dietary requirements during life cycle (C-6) | 2 | 54.5 | 77.8 |
| C8. Nutrition-related Diseases | | | |
| 01. Identify individuals at high risk for developing nutrition-related diseases (C-1) | 1 | 14.0 | 14.0 |
| 02. Describe the characteristics of malnutrition, underweight, obesity and starvation (C-2) | 3 | 78.3 | 78.3 |
| 03. Predict the role of proper nutrition in preventing nutrition-related diseases (C-3) | 2 | 88.0 | 88.0 |
| 04. Identify causes and effects of different nutrition related diseases (C-4) | 5 | 64.0 | 80.0 |
| 05. Relate the biological function of body organs to nutrient utilization (C-5) | 3 | 76.0 | 76.0 |
| 06. Judge the value of different nutrients used for treatment of nutrition-related diseases (C-6) | 3 | 36.3 | 51.8 |

# SUMMARY AND RECOMMENDATIONS

The purpose of this study was to assess the need for developing an advanced course in nutrition at the fourth year level at AUCW based on the cognitive knowledge of students of the introductory course at the third year level. A criterion-referenced achievement test was used to measure the degree of achievement of the objectives.

Objectives for the eight concepts were constructed and a table of specifications was developed based on the eight concepts of the introductory course. This served as a guide for developing an evaluation type of instrument. The items were reviewed by judges from the Department of Food and Nutrition at Iowa State University. Based on the judges' review and results of a pilot test, 74 items were selected for this instrument.

The sample consisted of 29 students who had taken the introductory course in nutrition at the third year and were beginning their fourth year at AUCW. There was a single administration of the instrument.

Descriptive statistics were calculated. A cutoff score for level of mastery was determined. Degree of achievement of objectives for each concept was computed. Based on the degree of achievement of each concept, decisions have to be made for further instruction.

According to the cut-off score determined for this test, the overall achievement of concepts indicates that only three concepts out of eight were mastered by the students. These concepts are

History of Nutrition, Food Composition Tables, and Regulation of Food Intake. No basic instruction is suggested related to these three concepts for the advanced course; however, some areas need to be revised.

The five concepts which need further instruction are Energy Expenditure, Body Composition, Nutrient Composition, Developmental Nutrition, and Nutrition-related Diseases. Some areas within each concept need more instruction than other areas. This was evident by the degree of achievement of objectives for each area (Table 2).

Based on the findings of this study, the following recommendations are made to help in outlining the content for the advanced course:

1. More emphasis on nutrient composition of food to be included.

2. Other concepts which need further emphasis are:

    A. essential nutrients:

        1. Carbohydrates

        2. Proteins

        3. Lipids

        4. Complexes of carbohydrate, proteins, and lipids

        5. Nucleotides and nucleic acids

    B. Water and fat soluble vitamins

        a) Chemistry

        b) Biochemical function

        c) Metabolites, and antagonists

C. Physiological aspects of nutrition

1. Digestion and absorption including mechanisms of regulation of food intake.

2. Nutrient exchange and homeostatic control

D. Uses and limitations of food composition tables.

E. Recommended daily allowances for different nutrients during the life cycle.

F. Assessment of energy status changes through the life cycle.

G. Effect of different nutrients on growth and development.

H. Protein-calorie malnutrition diseases.

I. Nutritional anemias, Goiter and Xerophthalmia.

3. A whole unit on energy-yielding nutrients and energy requirements needs to be included with emphasis on:

a) Total energy expenditure

b) Factors contributing to total energy requirements

c) Calorimetry

d) Energy balance

e) Energy value of foods

4. More instruction is needed in the area of assessing nutritional status of the people by using anthropometric measurements. This concept can be further emphasized in the fourth level course in applied nutrition.

Other main concepts needed to be included in the advanced course

as important content for students who will be future nutritionists and dietitians are:

1. Stages in human growth and development
    a) Compositional changes during the life cycle
        1. Human fetal development
        2. Maternal weight gain
            a) distribution
            b) composition
        3. Nutritional requirements during pregnancy
        4. Compositional changes between birth and maturity
        5. Compositional changes with weight changes
            a) obesity, starvation
            b) energy deficit
            c) physical activity
2. Energy utilization and metabolism, metabolic path ways
3. Protein requirements
    a) Nitrogen balance
        1. effect of physiological state and body protein reserves
        2. effect of energy intake
        3. effect of essential amino acids and total nitrogen intake
    b) Evaluation of protein quality
4. Vitamins associated with energy and protein metabolism
5. Nutrients associated with hormone function

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# APPENDIX A. INTRODUCTORY COURSE OUTLINE AND OBJECTIVES

FSc 301/311
87/88

## Nutrition & Dietetics

Instructor: Badria Sulieman Bedri
School : School of Family Science
Year : Third Year
Duration : One year course - 2 semesters - 3hr/week
Objectives:

The ultimate goal is to integrate the functions of the nutrients with metabolic processes.

To understand the role of nutrients in the maintenance & functions of the human body.

N.B. The course is of two parts: Part one consists of basic nutrition; Part two consists of advanced nutrition.

Topics:

1. Body composition
2. Energy Expenditure
3. Regulation of food intake
4. Carbohydrates & Lipids in nutrition
5. Proteins & Amino acids in nutrition
6. Vitamins - Fat & water solubles vit.
7. Minerals - Water minerals
8. Digestion, absorption& utilization of nutrients.
9. Developmental nutrition - pregnancy & lactation.
10. Developmental nutrition/ infancy / childhood.
11. Nutrition during old age.
12. Recommended dietary allowances, food comp., food groups
13. Primary nutritional diseases - Starvation, obesity, PEM

Text books used:

1. R. Passmore & M.A. Eastwood; Human nutrition & dietetics; 8th ed. : Churchil Livingstone, New York, London, 1986.

2. Recommended dietary allowances; National Academy of Sciences; Latest ed. ; 9th ed, 1980.

N.B. There is not a perfect or one text book to be used in this class. So please choose the book that is easy to read and comprehend from the library covering the same topics.

Evaluation :

| | | |
|---|---|---|
| Exam 1 | 20% | at the end of 1st Semester |
| Exam 2 | 25% | |
| Exam 3 | 50% | at the end of the year |
| attendance | 5% | |

## Nutrition and Dietetics

Target group: Third year students at Ahfad University College in the Sudan.

### Concept 1. History of Nutrition

Objective: The third year students at Ahfad University will:

1.1 relate the development of nutrition as a science to other related fields (C-2)

1.1.1. T F Nutrition is a relatively new science that evolved from chemistry and physiology.

### Concept 2. Body Composition

Objective: 2.1 Identify the uses of anthropometric measurements (C-2)

2.1.1 T F The use of skinfold thickness measurements will provide sufficient data to assess percent body fat of individuals.

2.1.2 Skinfold thickness is used as an indicator of
a. length of skeleton.
b. total water and tissue masses.
c. subcutaneous fat.
d. whole body muscle mass.
e. skeletal muscle mass

2.1.3 T F Anthropometric measurements of children are usually used to assess growth patterns of children.

### Concept 3. Energy Expenditure

Objective: 3.1 estimate energy expenditure using different methods (C-2)

3.1.1 T F Measuring oxygen uptake by the lungs is an accurate method of estimating energy expended.

Objective: 3.2 distinguish among different activities involved in energy needed for basal metabolism (C-4)

3.2.1 Basal metabolic energy needs include
- a. respiration, circulation and digestion.
- b. respiration, physical activity and digestion.
- c. circulation and maintenance of muscle tone.
- d. respiration, circulation and glandular activity.
- e. growth, reproduction and activity.

3.2.2 When should the basal metabolic rate of an individual be measured?
- a. during moderate exercise
- b. immediately after exercising
- c. immediately after waking in the morning
- d. immediately after the evening meal
- e. before going to bed in the evening

Concept 4. Regulation of Food Intake

Objective: 4.1 identify different control mechanisms associated with regulation of food intake (C-4)

4.1.1 T F When starvation occurs, basal metabolism is increased.

4.1.2 T F Eating as a motor activity is dependent on the hypothalamus.

4.1.3 T F Sensations of hunger and satiety are associated with changes of the level of blood free fatty acids.

Concept 5. Nutrient Composition

Objective: 5.1 distinguish among nutrient-containing food (C-2)

5.1.1 T F Solid food may contain as much as 85% water.

5.1.2 T F The need for vitamin D is easily met as this vitamin is found in foods from plants and animals.

5.1.3 The nutrient class that does not appear to be essential for the diet of an adult man is
- a. carbohydrates
- b. fats
- c. proteins
- d. minerals
- e. vitamins

5.1.4 Which food has the highest percentage of carbohydrate?
a. potatoes
b. sugar
c. macaroni
d. rice
e. bread

5.1.5 Which of the following is present in larger amounts in an egg than in a potato?
a. carbohydrates
b. protein
c. cellulose
d. vitamin C
e. vitamin D

5.1.6 Which food in highest in fat content?
a. spinach
b. oranges
c. carrot
d. cheese
e. rice

Objective: 5.2 predict the properties and physiological role of essential nutrients (C-3)

5.2.1 T F Fat is readily digested and absorbed by humans.

5.2.2 T F Ferritin is an iron storage protein found primarily in the liver, spleen, and bone marrow.

5.2.3 T F One of the distinctions between oils and solid fats is the melting point.

5.2.4 T F Absorption of fats, carbohydrates and proteins is regulated by the body's need for these nutrients.

5.2.5 T F The protein of meat is of higher quality than that of fruits and vegetables.

5.2.6 T F Vitamins and minerals yield no calories.

5.2.7 The digestion and absorption of dietary fat is important in the absorption of
a. vitamin E
b. thiamin
c. amino acids
d. sodium
e. iron

5.2.8 The mineral which is found most abundantly in the body is
a. iron
b. phosphorus
c. calcium
d. fluoride
e. copper

5.2.9 The mineral absorbed <u>least</u> <u>efficiently</u> by a well-nourished person is
a. iron
b. calcium
c. iodine
d. phosphorus
e. sodium

5.2.10 Which of the following is the major intracellular cation?
a. sodium
b. potassium
c. chloride
d. magnesium
e. calcium

5.2.11 The mineral necessary for initiation of blood clotting is
a. sodium.
b. calcium.
c. phosphorus.
d. magnesium.
e. potassium.

5.2.12 Fat soluble vitamins are
a. lost in cooking.
b. fat emulsifiers.
c. lost in perspiration.
d. excreted in the urine.
e. stored in the body.

5.2.13 Which of the following does not describe a vitamin?
- a. organic substance
- b. can be an essential source for energy
- c. needed in very small amounts
- d. performs specific metabolic role
- e. can be lost during food preparation

Objective: 5.3 Categorize different sources of dietary nutrients according to their caloric and biological value (C-4)

5.3.1 Which of these foods has the highest proportion of protein by weight?
- a. banana
- b. kidney beans
- c. corn
- d. sweet potatoes
- e. lettuce

5.3.2 Which of the following foods contain the most calories?
- a. whole milk
- b. butter
- c. Tahnia
- d. Tahina
- e. cheese

5.3.3 A source of high-quality protein is
- a. bread.
- b. peas.
- c. fish.
- d. nuts.
- e. sweet potatoes.

Objective: 5.4 interpret the caloric and biological value of major nutrients (C-6)

5.4.1 Naturally occurring emulsified fat is found in
- a. poultry.
- b. egg yolk.
- c. homogenized milk.
- d. whipped margarine.
- e. beef.

5.4.2 Protein in body fluids aids in
- a. building protein.
- b. acting as buffer.
- c. creating an acid condition in body fluids.
- d. creating an alkaline condition in body fluids.
- e. carrying water-soluble vitamins.

5.4.3 The protein that forms the framework of bone is
- a. hemoglobin.
- b. casein.
- c. fibrin.
- d. collagen.
- e. keratin.

5.4.4 In an adult, a daily deficit of 500 kcal should result in the loss of body weight of approximately
- a. 0.5 kg daily.
- b. 1 kg weekly.
- c. 0.5 kg weekly.
- d. 0.25 kg daily.
- e. 2.5 kg weekly.

5.4.5 A food that provides 150 kcal per 100 gm and is 5% protein and 10% fat by weight contains about
- a. 85% carbohydrate.
- b. 50% carbohydrate.
- c. 15% carbohydrate.
- d. 10% carbohydrate.
- e. 4% carbohydrate.

5.4.6 Minerals are not essential as
- a. sources of energy.
- b. catalysts to release energy.
- c. regulators of acid-base balance.
- d. regulators of water balance.
- e. part of essential body compounds.

5.4.7 Lactose has a favorable effect on calcium absorption because it
- a. helps keep calcium from precipitating.
- b. favors the growth of Lactobacillus bifidus.
- c. increases the permeability of cell membrane.
- d. occurs in milk along with calcium.
- e. stabilizes vitamin D.

5.4.8 Vitamin C aids in iron absorption by
- a. stimulating erythropoiesis.
- b. stimulating production of the hormone erythropoietin.
- c. stimulating ferritin production.
- d. releasing transferrin.
- e. reducing ferric iron to ferrous.

5.4.9 Controlled fluoridation of the water supply results in
- a. decreased incidence of dental caries.
- b. increased incidence of tooth decay in children.
- c. mottled tooth enamel.
- d. formation of kidney stones.
- e. earlier deaths in persons over 60.

5.4.10 Chromium is considered an essential nutrient because it is needed for
- a. synthesis of thyroxin.
- b. blood clotting.
- c. absorption of vitamin $b^{12}$.
- d. utilization of glucose.
- e. prevention of tooth decay.

Concept 6. Food Composition Tables

Objective: 6.1 identify the major nutrients in each food group (C-1)

6.1.1 Red meat is an excellent source of
- a. calcium.
- b. iron.
- c. vitamin C.
- d. vitamin D.
- e. riboflavin.

6.1.2 Milk and milk products are excellent sources of
- a. iron.
- b. vitamin A.
- c. ascorbic acid.
- d. calcium.
- e. carbohydrate.

Concept 7. Developmental Nutrition (pregnancy, lactation, infancy, childhood, adults and older adults)

Objective: 7.1 describe nutrient requirements during pregnancy, lactation, infancy, childhood, adults, and older adults (C-1)

7.1.1 T F Nutrient requirements for the older adult are greater than for any other stage of the life cycle.

Objective: 7.2 predict the essential nutrients required for different physiological aspects of life (C-2)

7.2.1 T F The amount of each nutrient that the body requires is exactly known.

7.2.2 T F The requirement for amino acids/kg of body weight is greater in infancy than in lactation.

7.2.3 T F The energy requirements for persons over age 50 are reduced to 50% of that of adults.

7.2.4 The nutrient needed in the largest amount during the life cycle is
a. protein.
b. water.
c. carbohydrate.
d. vitamins.
e. minerals.

7.2.5 Which group listed below is essential amino acids?
a. linoleic, proline, and glutamic acid
b. phenylalanine, lysine, and glutamic acid
c. lysine, phenylalanine, and linoleic acid
d. lysine, phenylalanine and tryptophan
e. histidine, lysine, and proline

Objective: 7.3 identify necessary dietary food during pregnancy (C-4)

7.3.1 T F The nutritional quality of the diet is more important during the last trimester than during the first and second trimesters of pregnancy.

7.3.2 During pregnancy a good source of vitamin A would be
a. one carrot.
b. one beef chop.
c. two cups of whole milk.
d. one banana.
e. one orange.

7.3.3 For which of the following can the increased requirements during pregnancy be met by diet rather than supplements?
a. protein
b. folacin
c. vitamin D
d. iron
e. all of the above

Objective: 7.4 explain the influence of breastfeeding on infant nutrition (C-5)

7.4.1 T F Breast milk from a healthy mother will meet the nutritional needs of her newborn infant.

7.4.2 T F A variety of drugs can be passed through the breast milk from a nursing mother to her infant.

Objective: 7.5 justify dietary requirements during pregnancy, lactation, infancy, childhood, adults and older adults (C-6)

7.5.1 Needs for pyridoxine in infancy are dependent on the amount of _____ in the diet.
a. fat
b. calories
c. thiamin
d. lysine
e. protein

7.5.2 After 6 months of age, an infant receiving only breast milk should receive a supplement of
a. vitamin A.
b. vitamin B.
c. vitamin D
d. calcium.
e. iron.

Concept 8. Nutrition-related Diseases

Objective: 8.1 identify individuals at high risk for developing nutrition-related diseases (C-1)

8.1.1 The individuals most at risk of developing a vitamin K deficiency are
a. the elderly.
b. vegetarians.
c. pregnant women.
d. infants.
e. alcoholics.

Objective: 8.2 describe the characteristics of malnutrition, underweight, obesity and starvation (C-2)

8.2.1 T F When obesity results, it is usually due to an imbalance between energy intake and expenditure.

8.2.2 T F During starvation the concentration of free fatty acids in adipose tissues decreases.

8.2.3 Kwashiorkor usually occurs in
a. newborn infants.
b. children under one year of age.
c. children that have been weaned.
d. teenagers.
e. pregnant women.

Objective: 8.3 predict the role of proper nutrition in preventing nutrition-related diseases (C-3)

8.3.1 T F Nicotinic acid helps in prevention of pellagra.

8.3.2 An iodine deficiency can result in
a. hyperthyroidism.
b. goiter.
c. anemia.
d. hypoparathyroidism.
e. tetany.

Objective: 8.4 identify the causes and effects of different nutrition-related diseases (C-4)

8.4.1 T F Iodine therapy is seldom effective in treatment of simple goiter.

8.4.2 T F Low fat intakes in a population are associated with high serum cholesterol levels and high incidence of coronary heart disease.

8.4.3 T F Pernicious anemia affects not only the blood but also the gastrointestinal tract and the peripheral and central nervous system.

8.4.4 Nutritional anemia may be due to a dietary deficiency of
a. iron or vitamin $B^{12}$.
b. iron or vitamin $B^{6}$.
c. iron and cobalamin.
d. protein and vitamin $B^{6}$.
e. all of the above.

8.4.5 Pernicious anemia is caused primarily by a lack of
a. iron.
b. copper.
c. vitamin $B^{12}$.
d. pyridoxine.
e. ascorbic acid.

Objective: 8.5 relate the biological function of body organs to nutrient utilization (C-5)

8.5.1 T F The greatest loss of water from the body is usually through the kidneys.

8.5.2 T F In severe protein-energy malnutrition, the gastro-intestinal tract is incapable of digesting a sufficient amount of protein foods.

8.5.3 When sodium intake is more than the kidneys are able to excrete
a. the level of sodium in the blood decreases.
b. the level of sodium in the intercellular fluid decreases.
c. there is an increase of blood pressure.
d. the thirst mechanism is stimulated.
e. both c and d.

Objective: 8.6 judge the value of different nutrients used for treatment of nutrition-related diseases (C-6)

8.6.1 Which of the following in not recommended in the treatment of iron-deficiency anemia?
a. increase ascorbic acid content of the diet.
b. continued use of therapeutic doses of iron salts once normal hemoglobin levels are reached.
c. gradual build up of therapeutic doses of iron salts.
d. use of an iron rich diet.
e. daily doses of ferrous sulfate.

8.6.2 Megaloblastic anemia in adults can be treated by
- a. a diet high in carbohydrates.
- b. blood transfusion.
- c. daily doses of folic acid.
- d. a diet high in fat.
- e. both b and c.

8.6.3 Rickets in children can be treated by
- a. vitamin A and calcium.
- b. vitamin D and calcium.
- c. vitamin C and calcium.
- d. vitamin E and calcium.
- e. vitamin $B^6$ and calcium.

# APPENDIX B. INSTRUMENT

FN 301 Exam

Read the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

T F 1. Nutrition is a relatively new science that evolved from chemistry and physiology.

T F 2. The use of skinfold thickness measurements will provide sufficient data to assess percent body fat of individuals.

T F 3. Anthropometric measurements of children are usually used to assess growth patterns of children.

T F 4. Measuring oxygen uptake by the lungs is an accurate method of estimating energy expended.

T F 5. When starvation occurs, basal metabolism is increased.

T F 6. Eating as motor activity is dependent on the hypothalamus.

T F 7. Sensations of hunger and satiety are associated with changes of the level of blood free fatty acids.

T F 8. Solid food may contain as much as 85% water.

T F 9. The need for vitamin D is easily met as this vitamin is found in foods from plants and animals.

T F 10. Fat is readily digested and absorbed by humans.

T F 11. Ferritin is an iron storage protein found primarily in the liver, spleen, and bone marrow.

T F 12. One of the distinctions between oils and solid fats is the melting point.

T F 13. Absorption of fats, carbohydrates, and proteins is regulated by the body's need for these nutrients.

T F 14. The protein of meat is of higher quality than that of fruits and vegetables.

T F 15. Vitamins and minerals yield no calories.

T F 16. Nutrient requirements for the older adult are greater than for any other stage of the life cycle.

T F 17. The amount of each nutrient that the body requires is exactly known.

T F 18. The requirement for amino acids/kg of body weight is greater in infancy than in lactation.

T F 19. The energy requirements for persons over age 50 are reduced to 50% of that of adults.

T F 20. The nutritional quality of the diet is more important during the last trimester than during the first and second trimesters of pregnancy.

T F 21. Breast milk from a healthy mother will meet the nutritional needs of her newborn infant.

T F 22. A variety of drugs can be passed through the breast milk from a nursing mother to her infant.

T F 23. When obesity results, it is usually due to an imbalance between energy intake and expenditure.

T F 24. During starvation the concentration of free fatty acids in adipose tissues decreases.

T F 25. Nicotinic acid helps in prevention of pellagra.

T F 26. Iodine therapy is seldom effective in treatment of simple goiter.

T F 27. Low fat intakes in a population are associated with high serum cholesterol levels and high incidence of coronary heart disease.

T F 28. Pernicious anemia affects not only the blood but also the gastrointestinal tract and the peripheral and central nervous system.

T F 29. The greatest loss of water from the body is usually through the kidneys.

T F 30. In severe protein-energy malnutrition, the gastrointestinal tract is incapable of digesting a sufficient amount of protein foods.

Select the best answer.

31. Skinfold thickness is used as an indicator of
    a. length of skeleton.
    b. total water and tissue masses.
    c. subcutaneous fat.
    d. whole body muscle mass.
    e. skeletal muscle mass.

32. Basal metabolic energy needs include
    a. respiration, circulation, and digestion.
    b. respiration, physical activity, and digestion.
    c. circulation and maintenance of muscle tone.
    d. respiration, circulation, and glandular activity.
    e. growth, reproduction, and activity.

33. When should the basal metabolic rate of an individual be measured?
    a. during moderate exercise
    b. immediately after exercising
    c. immediately after waking in the morning
    d. immediately after the evening meal
    e. before going to bed in the evening

34. The nutrient class that does not appear to be essential for the diet of an adult man is
    a. carbohydrates.
    b. fats.
    c. proteins.
    d. minerals.
    e. vitamins.

35. Which food has the highest percentage of carbohydrate?
    a. potatoes
    b. sugar
    c. macaroni
    d. rice
    e. bread

36. Which of the following is present in larger amounts in an egg than in a potato?
    a. carbohydrates
    b. protein
    c. cellulose
    d. vitamin C
    e. vitamin D

37. Which food is highest in fat content?
    a. spinach
    b. oranges
    c. carrot
    d. cheese
    e. rice

38. The digestion and absorption of dietary fat is important in the absorption of
    a. vitamin E.
    b. thiamin.
    c. amino acids.
    d. sodium.
    e. iron.

39. The mineral which is found most abundantly in the body is
    a. iron
    b. phosphorus
    c. calcium
    d. fluoride
    e. copper

40. The mineral absorbed Least efficiently by a well-nourished person is
    a. iron.
    b. calcium.
    c. iodine.
    d. phosphorus.
    e. sodium.

41. Which of the following is the major intracellular cation?
    a. sodium
    b. potassium
    c. chloride
    d. magnesium
    e. calcium

42. The mineral necessary for the initiation of blood clotting is
    a. sodium
    b. calcium
    c. phosphorus
    d. magnesium
    e. potassium

43. Fat soluble vitamins are
    a. lost in cooking.
    b. fat emulsifiers.
    c. lost in perspiration.
    d. excreted in the urine.
    e. stored in the body.

44. Which of the following does not describe a vitamin?
    a. organic substance
    b. can be an essential source for energy
    c. needed in very small amounts
    d. performs specific metabolic role
    e. can be lost during food preparation

45. Which of these foods has the highest proportion of protein by weight?
    a. banana
    b. kidney beans
    c. corn
    d. sweet potatoes
    e. lettuce

46. Which of the following foods contains the most calories?
    a. whole milk
    b. butter
    c. Tahnia
    d. Tahina
    e. cheese

47. A source of high-quality protein is
    a. bread.
    b. peas.
    c. fish.
    d. nuts.
    e. beef.

48. Naturally occurring emulsified fat is found in
    a. poultry.
    b. egg yolk.
    c. homogenized milk.
    d. whipped margarine.
    e. beef.

49. Protein in body fluids aids in
    a. building protein.
    b. acting as a buffer.
    c. creating an acid condition in body fluids.
    d. creating an alkaline condition in body fluids.

50. The protein that forms the framework of bone is
    a. hemoglobin.
    b. casein.
    c. fibrin.
    d. collagen.
    e. keratin.

51. In an adult, a daily deficit of 500 kcal should result in the loss of body weight of approximately
    a. 0.5 kg daily.
    b. 1 kg weekly.
    c. 0.5 kg weekly.
    d. 0.25 kg daily.
    e. 2.5 kg weekly.

52. A food that provides 150 kcal per 100 gm and is 5% protein and 10% fat by weight contains about
    a. 85% carbohydrate.
    b. 50% carbohydrate.
    c. 15% carbohydrate.
    d. 10% carbohydrate.
    e. 4% carbohydrate.

53. Minerals are not essential as
    a. sources of energy.
    b. catalysts to release energy.
    c. regulators of acid-base balance.
    d. regulators of water balance.
    e. part of essential body compounds.

54. Lactose has a favorable effect on calcium absorption because it
    a. helps keep calcium from precipitating.
    b. favors the growth of Lactobacillus bifidus.
    c. increases the permeability of cell membrane.
    d. occurs in milk along with calcium.
    e. stabilizes vitamin D.

55. Vitamin C aids in iron absorption by
    a. stimulating erythropoiesis.
    b. stimulating production of the hormone erythropoietin.
    c. stimulating ferritin production.
    d. releasing transferrin.
    e. reducing ferric iron to ferrous.

56. Controlled fluoridation of the water supply results in
    a. decreased incidence of dental caries.
    b. increased incidence of tooth decay in children.
    c. mottled tooth enamel.
    d. formation of kidney stones.
    e. earlier deaths in persons over 60.

57. Chromium is considered an essential nutrient because it is needed for
    a. synthesis of thyroxin.
    b. blood clotting.
    c. absorption of vitamin $B^{12}$.
    d. utilization of glucose.
    e. prevention of tooth decay.

58. Red meat is an excellent source of
    a. calcium.
    b. iron.
    c. vitamin C.
    d. vitamin D.
    e. riboflavin.

59. Milk and milk products are excellent sources of
    a. iron.
    b. vitamin A.
    c. ascorbic acid.
    d. calcium.
    e. carbohydrate.

60. The nutrient needed in the largest amount during the life cycle is
    a. protein.
    b. water.
    c. carbohydrate.
    d. vitamins.
    e. minerals.

61. Which group listed below is essential amino acids?
    a. linoleic, proline, and glutamic acid
    b. phenylalanine, lysine, and glutamic acid
    c. lysine, phenylalanine, and linoleic acid
    d. lysine, phenylalanine, and tryptophan
    e. histidine, lysine, and proline

62. During pregnancy, a good source of vitamin A would be
    a. one carrot.
    b. one beef shop.
    c. two cups of whole milk.
    d. one banana.
    d. one orange.

63. For which of the following can the increased requirements during pregnancy be met by diet rather than supplements?
    a. protein
    b. folacin
    c. vitamin D
    d. iron
    e. all of the above

64. Needs for pyridoxine in infancy are dependent on the amount of _____ in the diet.
    a. fat
    b. calories
    c. thiamin
    d. lysine
    e. protein

65. After six months of age, an infant receiving only breast milk should receive a supplement of
    a. vitamin A.
    b. vitamin $B^1$.
    c. vitamin D.
    d. calcium.
    e. iron.

66. The individuals most at risk of developing a vitamin K deficiency are
    a. the elderly.
    b. vegetarians.
    c. pregnant women.
    d. infants.
    e. alcoholics.

67. Kwashiorkor usually occurs in
    a. newborn infants.
    b. children under one year of age.
    c. children that have been weaned.
    d. teenagers.
    e. pregnant women.

68. An iodine deficiency can result in
    a. hyperthyroidism.
    b. goiter.
    c. anemia.
    d. hypoparathyroidism.
    e. tetany.

69. Nutritional anemia may be due to a dietary deficiency of
    a. iron or vitamin $B^{12}$.
    b. iron of vitamin $B^{6}$.
    c. iron and cobalamin.
    d. protein and vitamin $B^{6}$.
    e. all of the above.

70. Pernicious anemia is caused primarily by a lack of
    a. iron.
    b. copper.
    c. vitamin $B^{12}$.
    d. pyridoxine.
    e. ascorbic acid.

71. When sodium intake is more than the kidneys are able to excrete
    a. the level of sodium in the blood decreases.
    b. the level of sodium in the intercellular fluid decreases.
    c. there is an increase of blood pressure.
    d. the thirst mechanism is stimulated.
    e. both c and d.

72. Which of the following is not recommended in the treatment of iron-deficiency anemia?
    a. increase ascorbic acid content of the diet
    b. continued use of therapeutic doses of iron salts once normal hemoglobin levels are reached
    c. gradual build up of therapeutic doses of iron salts
    d. use of an iron rich diet
    e. daily doses of ferrous sulfate

73. Megaloblastic anemia in adults can be treated by
    a. a diet high in carbohydrate.
    b. blood transfusion.
    c. daily doses of folic acid.
    d. a diet high in fat.
    e. both b and c.

74. Rickets in children can be treated by
    a. vitamin A and calcium.
    b. vitamin D and calcium.
    c. vitamin C and calcium.
    d. vitamin E and calcium.
    e. vitamin $B^{6}$ and calcium.

# APPENDIX C. TABLE OF SPECIFICATIONS

TABLE OF SPECIFICATIONS

| Concepts | COGNITIVE Domain Level | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | C-1 | C-2 | C-3 | C-4 | C-5 | C-6 | No.of Items | % |
| 1. History of Nutrition | | 1 | | | | | 1 | 1.3 |
| 2. Body Composition | | 3 | | | | | 3 | 4.1 |
| 3. Energy Expenditure | 1 | | | 2 | | | 3 | 4.1 |
| 4. Regulation of Food Intake | 1 | | | 2 | | | 3 | 4.1 |
| 5. Nutrient Composition of Food | 5 | 6 | 8 | 3 | 10 | | 32 | 43.2 |
| 6. Food Composition Tables | 2 | | | | | | 2 | 2.7 |
| 7. Developmental Nutrition | 1 | 5 | 1 | 2 | 2 | 2 | 13 | 17.6 |
| 8. Nutrition-related Diseases | 1 | 4 | 2 | 5 | 3 | 2 | 17 | 22.9 |
| Total | 11 | 19 | 11 | 14 | 15 | 4 | 74 | |
| % | 14.9 | 25.7 | 14.7 | 18.9 | 20.3 | 5.4 | | 100 |

Note. Number of items in cells are based on a 74 item test.

# APPENDIX D. CORRESPONDENCE

Iowa State University of Science and Technology Ames, Iowa 50011-1120

Department of Family
& Consumer Sciences Education
219 MacKay Hall
Telephone: (515) 294-6444

October 1, 1987

Dr.
Department of Food and Nutrition
College of Family and Consumer Sciences

Dear Dr.

I am a graduate student from the Sudan working on my Master's degree in the Department of Family and Consumer Sciences Education at Iowa State University. The purpose of my thesis research is to develop a curriculum for an advanced course in Food and Nutrition at the 4th year level at Ahfad University College for Women in the Sudan which will be based on a need's assessment.

We would appreciate your assistance in evaluating the attached instrument which will be used for determining the Ahfad students' degree of mastery of food and nutrition concepts at the third year college level.

Please evaluate the instrument in terms of clarity of wording, accuracy of facts, and how well the items measure the objectives. Please return to Dr. Amos.

Thank you so much.

Sincerely,

Sidiga Washi
Graduate Student
Department of Family
and Consumer Sciences
Education

Rosalie J. Amos
Assistant Professor
Department of Family
and Consumer Sciences
Education

Iowa State University of Science and Technology Ames, Iowa 50011-1120

Department of Family
& Consumer Sciences Education
219 MacKay Hall
Telephone: (515) 294-6444

October 15, 1987

Dr. Gasim Bedri
Dean of Ahfad University College for Women
P.O. Box 167
Omdurman, Sudan

Dear Dr. Gasim:

I am a graduate student in the Department of Family and Consumer Sciences Education at Iowa State University. The purpose of my thesis research is to develop a curriculum for an advanced course in nutrition for the 4th year level at Ahfad University, based on a need assessment.

I would like to have the instrument for this research administered to the students at the 4th year level in the School of Family Sciences.

Thank you for your cooperation.

Sincerely,

Sidiga Washi
Graduate Student
Department of Family
and Consumer Sciences
Education

Rosalie Amos, Ph.D.
Assistant Professor
Department of Family
and Consumer Sciences
Education

Iowa State University of Science and Technology Ames, Iowa 50011-1120

Department of Family
& Consumer Sciences Education
219 MacKay Hall
Telephone: (515) 294-6444

October 15, 1987

Ms. Badria Bedri
School of Family Sciences
Ahfad University College for Women
P.O. Box 167
Omdurman, Sudan

Dear Badria:

Enclosed is the instrument for my thesis research. I will appreciate your cooperation in administering the instrument to the students at the 4th year level at the School of Family Sciences. The instrument needs to be administered within a one hour time period. Instructions are included on the test paper.

I would be grateful if you would send me back the answer sheets soon after administering the test.

Thank you very much.

Sincerely,

Sidiga Washi
Graduate Student
Department of Family
and Consumer Sciences
Education

Rosalie J. Amos, Ph.D.
Assistant Professor
Department of Family
and Consumer Sciences
Education

كلية الاحفاد الجامعيه للبنـات

AHFAD UNIVERSITY COLLEGE
FOR WOMEN

Your Ref:-

Our Ref:-

Date 3.11.87

P. O. Box 167 Telephone: 53363
OMDURMAN - SUDAN.

CABLE ADDRESS:- AHFAD-OMDURMAN

Mrs. Sidiga Washi
Graduate Student
Dept. of Family &
Consumer Sciences
Education, ISU,
219 Mackay Hall,
Ames, IA 50011

Dear Mrs. Sidiga:

With reference to your letter of 15.10.87, we would be glad to administer the instrument of your research to our 4th year students, School of Family Sciences, as soon as we receive it.

With best wishes and regards.

Sincerely

Dr. Gasim Bedri
Dean
Ahfad University College
for women, P.O.Box167,
Omdurman, Sudan