A Nutrition Analysis of Barstow College Students in USA
美國巴士度大學學生的營養分析

Zhenying Jiang
Department of Health, Barstow College, USA

姜鎮英
美國加州巴士度大學衛生健康系

Abstract

The purpose of this study is to examine and analyze the intake of calories and nutrients in the daily diet of students enrolled at Barstow College. The present analysis indicates that the majority of Barstow College students (male and female) have insufficient intake of complex carbohydrates and fiber, and too much intake of sugar. Inadequate intake of vitamins and minerals is also a common problem facing most of the students.

摘要

本文旨在分析美國加州巴士度大學學生進食的營養，調查結果顯示大部份男女生都普遍缺乏進食適量的碳水化合物及纖維質類食物，而偏向進食高糖份食物，導致出現缺乏足夠維他命和礦物質的情況。

Introduction

Excellent nutrition, and the resulting vigor and health associated with it, are related to balancing the nutrients in the foods we eat (nutrient composition). Excellent nutrition involves adjusting the calories we eat with the calories we use. The purpose of this study is to examine and analyze the intake of calories and nutrients in the daily diet of students enrolled at Barstow College.

Method

Subjects One hundred and eighty eight Barstow College students (131 females, 57 males) participated in the study. All of the subjects were from Health Education and Lifetime Fitness classes, age from 17 to 75.

Procedures

All of the subjects were asked to record all food intake in detail for 7 days (meal by meal - including snacks, day by day for one week). The data were input into a computerized program - Dine System. The mean of DINE Scores, total caloric intake, and nutrients were calculated for analysis.

Results

Dine Scores Based on a categorical scale from 0 to 10, the Dine Score reflects the quality of student's dietary intake (see Table 1 & 2, & Figure 1 & 2). The actual intake of nutrients is compared with dietary guidelines that have been calculated specifically for each student individually. The average Dine Score among the Barstow College students is 2.92.

Table 1. Means and Standard Deviations of Dine Scores for the Barstow College Students.

	Male (n=57)	Female (n=131)	Total (N=188)
Mean of Dine Scores	2.55	3.18	2.92
Standard Deviation	0.95	0.83	0.99

Table 2. The Distribution of Dine Scores for the Barstow College Students.

Dine Scores	Classification	Number of Students		Total
		Male	Female	
0 to 1.75	Very Poor	20(35%)	36(27%)	56(30%)
2 to 3.75	Poor	21(37%)	52(40%)	73(39%)
4 to 5.75	Fair	12(21%)	32(24%)	44(23%)
6 to 7.75	Good	3(5%)	9(7%)	12(6%)
8 to 10.0	Excellent	1 (2%)	2 (2%)	3 (2%)
Total		57(100%)	131(100%)	188(100%)

Total Calories

Table 3 shows the distribution of the total caloric intake between male and female students (according to the calculated guideline based on each different individual subject). Figure 3 compares the percentage difference between male and female Dine Scores.

Table 3. The Comparison of Total Caloric Intake between Male and Female Students at Barstow College.

	Total Caloric Intake			
	Under Guideline Suggested	Within the Range	Exceeds Guideline Suggested	Total
Male	5(8%)	10(18%)	42(74%)	57(100%)
Female	85(64%)	9 (7%)	37(28%)	131(100%)
Total	90(48%)	19(10%)	79(42%)	188(100%)

Large Nutrients The Large Nutrients represent the energy yielding nutrients and fiber which include protein, fat, complex carbohydrates, dietary fiber and sugar, which provide the energy or fuel for our metabolism and physical activity. They are needed in relatively large amounts. The Large Nutrients are measure in calories with the exception of dietary fiber, which is measured in grams. The results and comparison of the Large Nutrients analysis between Barstow College female and male students are as following (see Table 4, 5, 6 & Figure 4, 5, 6):

Table 4. The Distribution of Large Nutrients Intake for Students at Barstow College.

Large Nutrients	Under Guideline Suggested Cal. (%)	Within the Range Cal (%)	Exceeds Guideline Suggested Cal(%)
Protein	51(27%)	56(30%)	81(43%)
Fat	1(1%)	70(37%)	117(62%)
Carb.	160(85%)	27 (14%)	2(1%)
Fiber	159(84%)	26(14%)	3(2%)
Sugar	1(1%)	89(47%)	98(52%)

Total			N=188(100%)

Table 5. The Distribution of Large Nutrients Intake for Female Students at Barstow College.

Large Nutrients	Under Guideline Suggested Cal. (%)	Within the Range Cal (%)	Exceeds Guideline Suggested Cal(%)
Protein	48(37%)	47(36%)	36(27%)
Fat	1(1%)	62(47%)	68(52%)
Carb.	118(90%)	12 (9%)	1(1%)
Fiber	114(87%)	14(11%)	3(2%)
Sugar	1(1%)	70(53%)	60(46%)

Total			N=131(100%)

Table 6. The Distribution of Large Nutrients Intake for Male Students at Barstow College.

Large Nutrients	Under Guideline Suggested Cal. (%)	Within the Range Cal (%)	Exceeds Guideline Suggested Cal(%)
Protein	3 (5%)	9 (16%)	45(80%)
Fat	0 (0%)	8 (14%)	49(86%)
Carb.	42(73%)	15(26%)	1 (1%)
Fiber	42(73%)	12(21%)	0 (0%)
Sugar	0 (0%)	20(35%)	37(65%)

Total			N=57(100%)

Small Nutrients

The Small Nutrients are vitamins and minerals, which include cholesterol, sodium, potassium, vitamin A, vitamin C, calcium , iron, & phosphorus. They are needed to release the energy from the Large Nutrients and responsible for important chemical actions. Our bodies need only microscopic amounts of the Small Nutrients but they are vitally important to our health.

Table 7, 8 & 9 show the distribution of the small nutrients intake among the female and male students at Barstow College. Figure 7 shows the small nutrients intake among the subjects.

Table 7. The Distribution of Small Nutrients Intake for Barstow College Students.

Small Nutrients	Under Guideline Suggested mg (%)	Within the Range mg (%)	Exceeds Guideline Suggested mg (%)
Cholesterol	2 (1%)	102(54%)	84(45%)
Sodium	1 (1%)	97(52%)	90(48%)
Potassium	97(52%)	87 (46%)	4 (2%)
Vitamin A*	120(64%)	68(36%)	1 (1%)
Vitamin C	94(50%)	93(49%)	1 (1%)
Iron	102(68%)	29(32%)	0 (0%)
Calcium	144(77%)	44(23%)	0 (0%)
Phosphorus	103(55%)	83(44%)	2 (1%)

Total			N=188(100%)

Table 8. The Distribution of Small Nutrients Intake for Female Students at Barstow College.

Small Nutrients	Under Guideline Suggested mg (%)	Within the Range mg (%)	Exceeds Guideline Suggested mg (%)
Cholesterol	2 (2%)	87(66%)	42(32%)
Sodium	1 (1%)	79(60%)	51(39%)
Potassium	79(60%)	52(40%)	0 (0%)
Vitamin A*	90(68%)	41(31%)	1 (1%)
Vitamin C	66(50%)	64(49%)	1 (1%)
Iron	102(78%)	29(22%)	0 (0%)
Calcium	118(90%)	13(10%)	0 (0%)
Phosphorus	84(64%)	47(36%)	0 (0%)

Total			N = 133(100%)

Table 9. The Distribution of Small Nutrients Intake for Male Students at Barstow College.

Small Nutrients	Under Guideline Suggested mg (%)	Within the Range mg (%)	Exceeds Guideline Suggested mg (%)
Cholesterol	0 (0%)	15(26%)	42(74%)
Sodium	0 (0%)	18(32%)	39(68%)
Potassium	18(32%)	35 (61%)	4 (7%)
Vitamin A*	30(53%)	27(47%)	0 (0%)
Vitamin C	28(49%)	29(51%)	0 (0%)
Iron	25(44%)	32(56%)	0 (0%)
Calcium	26(46%)	31(54%)	0 (0%)
Phosphorus	19(33%)	36(63%)	2 (4%)
Total			N =57(100%)

** Unit counted as RE instead MG. Figure 8 & 9 compares the small nutrients intake between male and female students at Barstow College.*

Discussion

Dine Score & Total Caloric Intake

The Dine Score reflects the quality of students' dietary intake. It represents a comparison between the subjects' diet values and ideal diet values. The score is based upon eating food which contains nutrients within the recommended ranges. It also takes each subject's age, sex, height, frame size and activity level into consideration. Overeating or undereating, excess or lack of nutrients intake can all cause the poor or very poor dine score. The mean of Dine Scores for national college students is 3.31; for the industrial workers, is 3.93; and for the senior citizens, is 4.01 (Dennison & Dennison, 1990). At Barstow College, the students' average Dine Score is 2.92 (the average female score is 3.18; male average is 2.55). While 69% of Barstow students eat "poor" and "very poor", only 2% of the subjects score "Excellent", and 6% are "good".

With less than 10% of the students eating right, excessive eating (42%), and under-guideline total caloric intake (48%) become very serious problems facing most of Barstow College students. Eating consistently above students' energy needs leads to overweight and obesity and consequently to many nutrition related diseases. Dianne Hales (1993) reported that while every one out of four American adults is overweight, one out of three American children is considered overweight. She also pointed that every year there are 1.5 million Americans having heart attacks, 45 % of whom are under age 65; 1 million deaths are caused by cardiovascular disease; a half million suffer strokes; and 30% of Americans reveal some degree of hypertension. It is apparent that we have to take this nutrition intake more serious than ever before.

Undereating may make students more susceptible to health problems including lowered resistance to infectious disease and headaches. It is very difficult to obtain adequate nutrients from a diet very low in calories. Under-guideline suggested caloric intake is also the major reason which causes students to feel tired and may lead to binge eating due to ravenous hunger. Eating too few calories over time, especially among female students, may cause their metabolic rate (BMR) to drop as a survival mechanism response. To a large number of students, constantly on diet do not only make them regain their fat weight back (most of them maybe even heavier than before), but also ruin their health for the long term. High rate of drops, increased absences, and more sick days probably are some of the best indications of poor nutrients intake of Barstow College Students.

Nutrients

Protein (1 gram = 4 Calories)

Protein should provide the smallest range of recommended total intake, or 10 % - 15 % of calories. While 43 % of Barstow College Students over consume protein (80% of male students, and 27% of female students), 27% of students take too little protein (36% female, 5% male). Only 30% students consume protein within the recommended range. Although protein provides nitrogen and the essential and non-essential amino acids which are necessary to build new tissue and repair muscle tissue, it is not a good source of energy. Too much or too little protein may be harmful. Too much protein may crowd out other desirable nutrients, strain kidneys, and cause the human body to lose calcium, water, and potassium. Too little protein may cause slower wound healing and lower resistance to disease. While the majority of male students (80%) have to reduce their protein intake, about 64% of female students may need to adjust their protein intake.

Fats & Cholesterol (1 gram of Fat = 10 Calories)

The primary types of dietary fat are saturated fat and unsaturated fat. In the study of this nutrients intake analysis, total fats intake was calculated. Among all 188 subjects, 117 (62%) students' fat intake were 10% to 45% over their ideal caloric level (maximum of 30% of total calories per day). Only one subject's fat intake was under the suggested guidelines (0.5%). Both male (86%) and female (52%) students eat too much fat. The cholesterol intake shows the same pattern: 74% male and 32% of female subjects take more than 300 mg per day. Only 2 (1%) of total subjects took less than the recommended range. According to the American Institute for Cancer Research, high fat & cholesterol intake would not only increase the risk of heart disease, but may also promote lung cancer, breast cancer, colon cancer and prostate cancer (Alavanja, HanKin, & Howe, 1994). It is the time for our students to take some action to reduce the fat and cholesterol intake and to minimize the risk factors to their health.

Complex Carbohydrates and Fiber (1 gram = 4 Calories)

Complex carbohydrates are the primary source of energy and should be 50% to 80% of total calories intake. The recommended daily intake for fiber is 20 to 35 grams. Unfortunately, 160 of total 188 subjects (85 %) took less than 45 % of their ideal caloric level 118 out of 131 females (90%) and 42 out of 57 male subjects (73 %) have low carbohydrates intake. Ninety percent of females and 79% of male subjects took less than 20 grams of fiber per day. Carbohydrates not only provide the major source of many vitamins and minerals, but they also assist in metabolizing fat for use in physical activity, thereby sparing protein for other, more important functions such as transporting vitamins. Low complex carbohydrate and fiber ingestion may increase dysfunction problems and digestive disorders, including constipation, intestinal problems, and some types of associated cancer. The high incidence of obesity and heart disease can be related to eating small amounts of complex carbohydrates and large amounts of protein and fats.

Sugar

The average American consumes 127 pounds of sugar and 20 pounds of artificial sweetener annually (Politzer, 1991). At Barstow College, 52% of the subjects got more than 20% of their total calories from sugar. The recommended intake of sugar as indicated by the Dietary Goals for the U.S. should be 10 % or less of the total caloric intake. The most interesting phenomenon in this study is that we have more male students (65%) who like sweets than female (46%). If further study could be done, the students' dental problems might be probably even worse.

Sodium

The average daily intake of sodium from all sources should be 200mg (a tenth of a teaspoon) needed for normal maintenance of health. The National Research Council recommends as a safe intake a range between 500 - 2400mg per day for adults. But still, almost half of the students (48 %) took much more than 3300 - 7000mg per day. A diet too high in sodium can cause water retention, and lead to high blood pressure, a known risk factor for coronary heat disease, stroke, and kidney problems. A salt craving is learned and not based on a physiological need for more sodium. Desire for salt is related to one's use of salt and salty foods. If one uses a great deal of salt, one will desire greater amounts, but if one cuts down on salt, one will require less salt to satisfy one's taste for salt. Low sodium meals taste good once people acquaint themselves with the subtle flavorings naturally present in foods.

Potassium

While the most important function of potassium is to maintain the heartbeat, it also plays a major role in maintaining water balance. Fifty two percent of the subjects had a lack of potassium intake (with the female students: 60%). Inadequate potassium may lead to muscle cramps, weakness, and irregular heart rhythms. A low sodium, high potassium diet has been suggested to have a positive influence on the control of blood pressure. The ratio of sodium to potassium (S/P) should be adjusted to favor potassium. The lower the S/P ratio, the better (Hahn & Payne, 1994).

Vitamin A & C

While 64% of the total subjects have a shortage of vitamin A intake, 50% of the subjects do not take enough vitamin C. The primary uses of vitamin A relate to the adaptation of the eye to changes in light and in new cell growth for the formation of healthy skin tissue. Vitamin A is also important in maintaining the integrity of the mucous membranes which line the internal cavities of the body (Dennison, Dennison, & Markel, 1994). Vitamin C promotes healthy teeth, gums, joints, bones, connective tissue, and muscles. It is important for the absorption of iron, and aids in fighting infection. Rich sources of vitamin A and C include carrots, broccoli, spinach, oranges, grapefruit, kiwi fruit, and other dark green leafy vegetables.

Iron

Iron is the most important mineral in the body. It is concentrated in the red cells of the blood, stored in the liver, and traces of it are found in every cell. Muscle tissue, brain tissue, and all other body cell rely on iron for oxygen Christian & Greger. 1994). Fewer than one third of the total subjects (32%) have adequate iron intake. Sixty percent of the subjects do not have sufficient iron intake, especially the females. It may be the best explanation of why so many female students feel fatigue and suffer anemia all the time.

Phosphorus and Calcium

Phosphorus is involved in the transmission of genetic traits, transports fat in the blood stream, and absorbs glucose from the intestine. Perhaps its most important function is to make it possible for other nutrients to cross the cell membrane to nourish the cell. Eighty percent of phosphorus is joined with calcium in the bones and teeth. The remaining 20% is present in all the living cells of the body. The ratio of calcium to phosphorus should be 1:1 or less (Mullen, Gold, Belcastro & McDermott, 1993). More than 55% of subjects have deficiency

of phosphorus intake; 80% of females have this problem. Calcium is needed not only as a constant supply for bone tissue, but also for circulating in the body fluids. It is responsible for a number of important functions, including the blood clotting process, the absorption of vitamins, the maintenance of normal heart beat, nerve conduction and muscle contractions throughout the body. While 77% of total subjects have a lack of calcium intake (90 % of total females, and 46% of total males), less than 1/4 of the subjects (23%) have a intake calcium within the ideal range. Low calcium is associated with accelerated bone loss as the blood pulls calcium from the bones to carry on its essential functions. Osteoporosis, a condition characterized by loss of bone mass which makes the bones "brittle" and susceptible to fracture may result. There is also some evidence that an adequate intake of calcium may help to control blood pressure (Wardlaw, Insel & Seyler, 1994).

Summary and conclusion

This study indicates that the majority of Barstow College students (male and female) have insufficient intake of complex carbohydrates and fiber, and too much intake of sugar. Inadequate intake of vitamin A, Vitamin C, iron, and calcium is a common problem also facing most of the students. While the majority of male students eat too much fat, cholesterol, and protein, the majority of female students may lack the most important nutrients. Ignoring the above facts may cause very serious consequences and endangers our student health. It is the time to have some change and action.

Implications

1. Establish a College Students Health & Nursing Services.
2. Inspect all the food selling machines on campus, replace the high sugar, high fat food with high complex carbohydrates & balanced nutrients food.
3. Reopen the students' cafeteria under the guidelines of the U.S. Dept. of Health & Human Services.
4. Offer some new nutrition courses and healthful cooking classes at Barstow College.
5. The school board, administration, and student service division may need to pay more attention to this health issue.
6. More studies and actions (such as educational programs) are needed.
7. Prohibit the sale of junk food on campus for any reason.
8. The community, all students, and staff should get involved to create a healthful environment for our future. An "Eat Right Month" may be needed for all of us.

References

Alavanja, M., HanKin, J., & Howe, G. (1994). *High Fats Intake-the Promoter of Cancer*. American Institute for Cancer Research.

Christian, J., & Greger, J. (1994). *Nutrition for Living. (4th Ed.).* CA: Benjamin/Cummings.

Dennison, D., & Dennison, K. (1991). *Improve Your Nutrition and Health.* NY: Dine Systems.

Dennison, D., Dennison, K., & Markel, R. (1994). *The Five Star Nutrition Guide*. NY: Dine Systems.

Wardlaw, G., Insel, P., & Seyler, M. (1994). *Contemporary Nutrition - Issues and Insights*. MI: Mosby.

Hales, D. (1994). *An Invitation to Health (6th Ed.).* CA: Benjamin/Cummings.

Hahn, D., & Payne, W. (1994). *Focus on Health*. MI: Mosby.

Mullen, K., Gold, R., Belcastro, P., & McDermott, R. (1993). *Connection for Health*. Dubuque, IA: WCB Brown & Benchmark.

Politzer, B. (Sept. 1991). Sweet Talk: Sugar and Artificial Sweeteners. *American Health.*

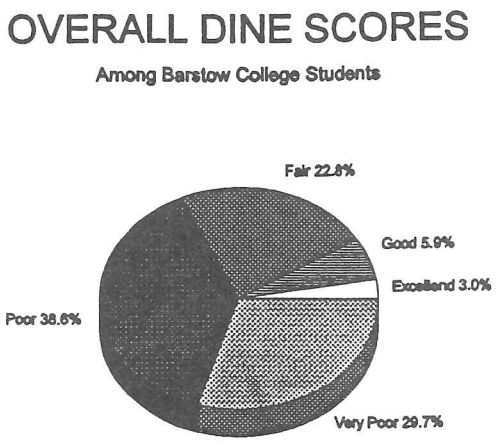

Figure 1

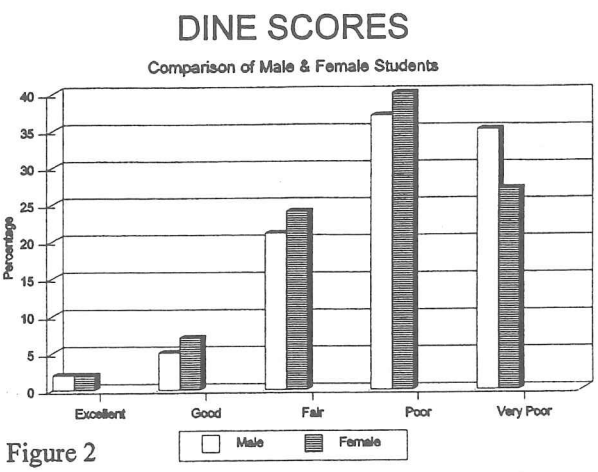

Figure 2

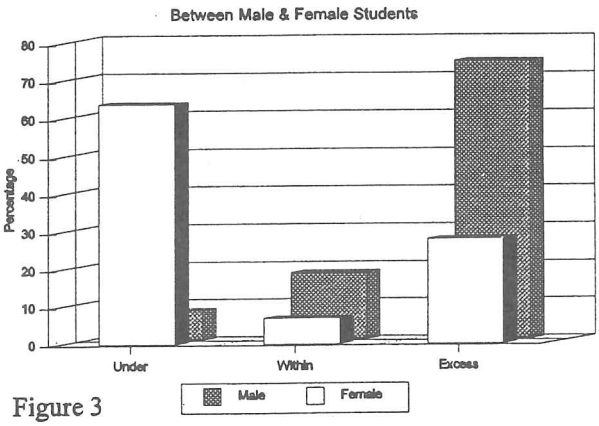

Figure 3

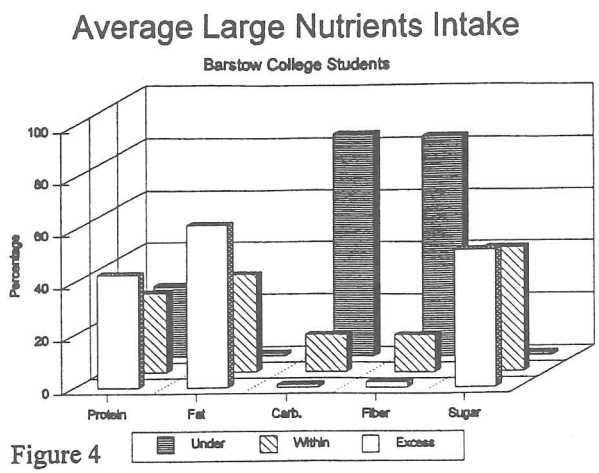

Figure 4

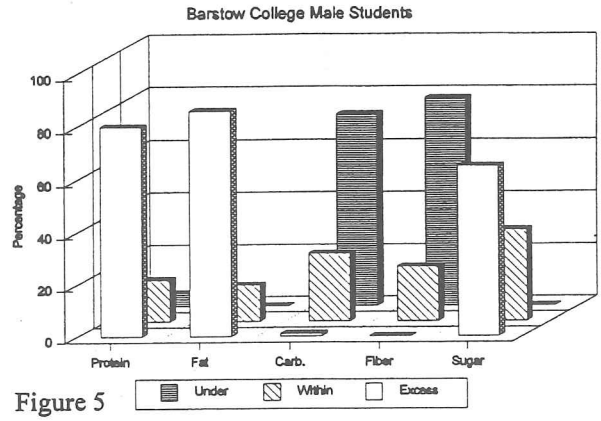

Figure 5

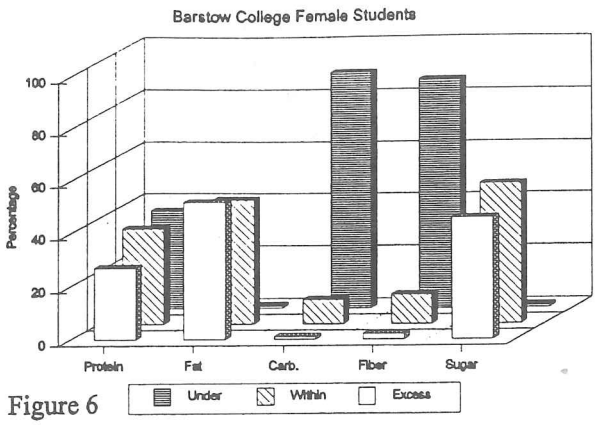

Figure 6

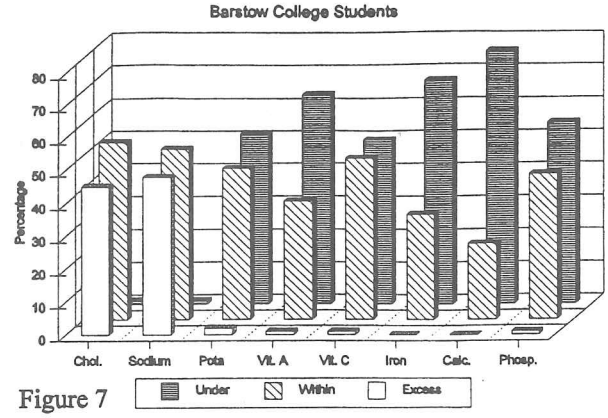

Figure 7

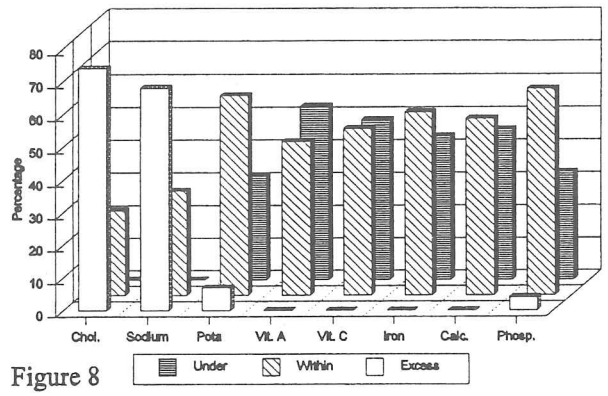

Figure 8

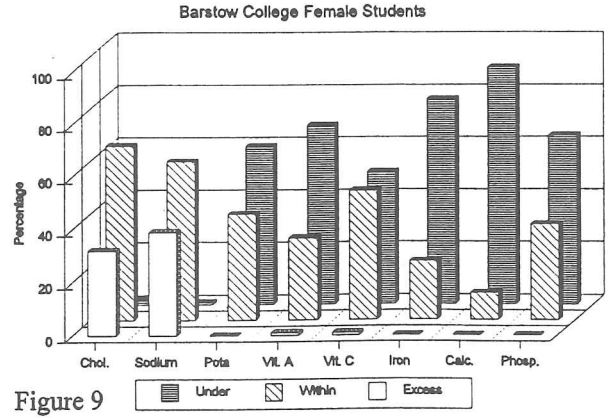

Figure 9