

## System for Nutrition Counseling and Screening\*

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### ABSTRACT

The studies on nutrition counseling and screening have been based on stand-alone program. This study introduces the nutrition counseling and screening management system. This system offers convenient user interface and the synthetic results of counseling and screening with various utilities. The system for nutrition counseling and screening consists of the general information of clients, the anthropometry data, the calculation of obesity and body mass index, the state of eating habits, the computation of calorie expenditure, the clinical symptoms, the convenient method for analysis of calorie and nutrients, nutrition prescription and alcoholism screening tests. Having interoperability, these functions preserve the information of clients and manage the historical data. The system inserts, stores and generates the synthetic information of clients, so it is able to provide suitable and efficient counseling to clients. The proposed system gathers various information of clients. With accumulated client data, it does the nutrition education, screening and counseling simultaneously. Managing clients' information connected to database, it can provide systematic and formal information. It is possible for the system to retrieve information and counsel in real time. It is expected that the nutrition counseling management system can improve the national health with animated nutrition counseling. (*J Community Nutrition* 7(4) : 220~229, 2005)

**KEY WORDS** : computer system · nutrition counseling · nutrition screening · nutrition prescription.

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### Introduction

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Prior to the development of computers and nutrition analysis software, it was difficult and time consuming to analyze the dietary intakes manually. Clearly computers are perfectly suited to this task of nutrient analysis, which is nothing more than number crushing, saving time, labor, and expense while reducing error. Hundreds of software programs have been developed since the mid-1980s for all sorts of nutrition-related tasks, including analysis of food records and food frequency questionnaires, menu planning and forecasting, analysis of recipe, food service and food management tasks, nutrition education, patient interviews and counseling, and research (Han 1997a ; Han 1997b ; Hong 1989 ; Hong 1996 ; Kang et al. 1998 ; Kang et al. 1999 ; Kolasa, Miller 1996 ;

Lee, Nieman 2003 ; Peter et al. 1998). CAN (computer aided Nutritional analysis program) and CAN-Pro 2.0 of The Korean Nutrition Society (The Korean Nutrition Information Center 2002), Diet assessment system of National Rural Living Science Institute, food service management system of The Korean Dietetic Association, etc. were developed and used (Hong 1989 ; Hong, Hwang 2001 ; Hong et al. 2004) Some software package such as NACS2000 (Nutritional Analysis & Consult Service), CAFS2000 (Computer Aided Food Service) and FSM-21 (Food Service Management) had been developed. By having a computer at the work site, nutrition counselors can obtain and assess dietary history information, anthropometry information, eating habits, psychological information, activity and energy expenditure, food intakes and nutrients information more efficiently and accurately. The use of software package for nutrition education and counseling is very efficient. At the same time, use of the internet through work and home personal computers expanded during the late 1990s and commonplace early in the twenty-first century. Thousands of websites provide nutrition-based information such as obesity, BMI, energy expenditure, eating habits, biochemical information, food composition information, nutrient

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analysis and menu planning (Hong et al. 2004 ; Hong, Kim 2004 ; Lee, Nieman, 2003). Internet nutrition analysis systems were developed and used such as MenuGen of Rural Resources Development Institute (Hong et al. 2004), system for nutritional assessment and diagnosis of dietary intakes (Han 2000), nutrition counseling and diet management (Han, Jeong 2004), food exchange system (Hong et al. 2003 ; Hong et al. 2004), nutrition counseling system (Hong 2004). Until now, online or stand-alone nutrient counseling programs are being developed continuously. Nevertheless, the program that makes the synthetic nutrient counseling data and stores it is insufficient, so there are troubles in nutrition education and counseling. Nowadays internet-based nutrient programs are used actively. But if users cannot access internet or have an outside service for public welfare without using Internet, the off-line programs are required earnestly. So there is necessity for the program that can make nutrient screening and nutrition prescription for all age groups and male and female. We think that stand-alone nutrition screening program is composed of 1) general management of client's information, 2) anthropometry data and calculation of obesity, 3) status of eating habits, 4) calorie expenditure, 5) nutrition screening, 6) nutrition prescription and 7) alcoholism screening tests, etc. Especially alcohol consumption is a very important nutrition problems such as calorie intakes, over nutrition and alcoholism. According to the report on National Health and Nutritional Survey (NHNS) in Korea, the drinking population in adult males aged over 20 was increased from 74.8% in 1998

to 80.9% in 2003, and it is surprising that 6.0% of males aged 20 – 59 were drinking almost everyday in 1988 and 9.3% in 2003 (Korea National Statistical Office 2003 ; Nam et al. 2000). Hence in this paper, we developed the advanced nutrition counseling and screening system. This system is able to input of data, calculate, print and modify the client's nutrition data. It is able to manage the data continuously. We expect that this system will contribute to the nation's health promotion with active nutrition counseling and systematic management of data.

## Materials and Methods

### 1. The constituent of system

The system is a stand-alone program with a personal computer. With relatively easy interface, users are able to make use of the system's functions. This system can be used for nutrition screening and counseling for everybody including patients. Table 1 shows constituents of the system.

### 2. Our approach

This system makes use of all the user's information. The user's anthropometry data like as height, weight and so on can be changed. These factors are used to the user's historical screening. For user convenience, each anthropometry data factors can be updated when the user wants to.

The system makes value of user age, age of month and age level with the former 6 numbers of personal identification

**Table 1.** The constituents of nutrition counseling and screening system

Category	Input data	Screening results
General Information	Information of the clients : age, sex, address, height, weight	Client's general information on the head of output materials
Anthropometry data	Height, weight, waist and hip circumference	Ideal body weight, range of ideal body weight, percent Ideal body weight, Obesity, BMI, Rohrer index, Kaup index, ponderal index, W/H ratio, energy recommended
Computation of calorie expenditure	Calorie expenditure, Indirect calorie expenditure	Basal metabolic rate, calorie expenditure for activity, specific dynamic action, total calorie expenditure
Status of eating habits and convenient nutrient analysis	General eating habits, eating habits for hyperlipidemia, semi-quantitative food intake for convenient nutrient analysis	Analysis of eating habits, nutrient analysis and alcohol consumption
Nutrition prescription	Make nutrition prescription for clients such as calorie consumption	Result of each test, synthetic prescription and counseling
Alcoholism screening tests	CAGE (Cutting, Annoyance by criticism, Guilty feeling, Eye-opener) NAST (National alcoholism screening test), AUDIT-K (Alcohol use disorders identification test-Korean)	Diagnosis of alcohol abuse and alcoholism

number(birthday). These values are the basic input data for other functions like computation, prescription and screening tests.

### 3. Program language and database

This system can be set to general personal computer. The development language is Visual Basic of Microsoft. The database is Microsoft Access 2000. This system considers convenient interfaces for users. Table 2 shows the specifications of the system.

## Results and Discussion

### 1. Program contents

The nutrition counseling and screening system is composed of client's general information, anthropometry data, computation of calorie expenditure, status of eating habits and convenient nutrient analysis, nutrition prescription, alcoholism screening tests, etc. Client's information and the result of each test are manipulated using a database.

General information can manage not only the customer's information but also the sub-customer's information. Namely, a user can own his or her clients. Nutrition history stores the history of client's health, eating habits and nutrient analysis.

**Table 2.** Specification of the system environment

Client	Microsoft Windows 95, 98, 2000, XP
Development language	Microsoft Visual Basic 6.0
Database	Microsoft Access 2000

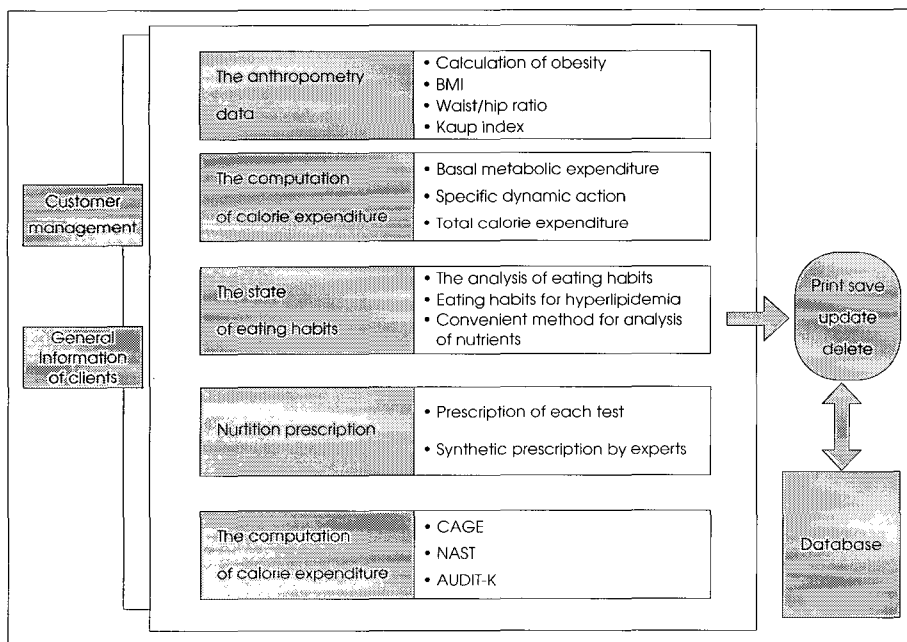
The system can append the counselor's prescription to the histories (Hong 2005).

As the client's properties change, the anthropometry data processes a calculation of obesity, standard weight, BMI, Broca based on the client's general information. The computation of calorie expenditure is divided into direct and indirect method of measurement. The status of eating habits is composed of the test of eating habits, the self-test of eating habits and semi-quantitative food intake for convenience nutrient analysis. The nutrition prescription manages the result of each test and the counseling records.

This system does not measure the counseling of clients once it connects the records with database and manages the information of clients systematically. This can provide more timely and efficient counseling using the customer's accumulated data.

As described above, this system has new added functions extent to the various anthropometry data, computation of calorie expenditure, status of eating habits and convenient nutrient analysis, nutrition prescription and alcoholism screening tests like as CAGE (Cutting, Annoyance by criticism, Guilty Feeling, Eye-opener), NAST (National Alcoholism Screening Test) and AUDIT-K (Alcohol Use Disorders Identification Test-Korean).

This system provides more various computation results than other software package such as CAN, CAN Pro 2.0, CAFS2000, NACS2000 and FSM-21 with adding Rohrer, Kaup, Ponderal Index, etc. (Damoan Information Technology



**Fig. 1.** System flow.

Corp. 2000 ; Han 1997a ; Lee and Nieman 2003 ; The Korean Dietetic Association 2000 ; The Korean Nutrition Information Center 2002). These functions are remarkable compared with legacy program and can be used for nutrition counseling and screening efficiently.

**2. Customer management**

The nutrition counseling and screening system stores the user's fundamental data to database with registering user. Each test and its results are interoperated using the registered user's information. Fig. 2. shows the fundamental user registration processing. User's sex is concerned with the recommended calorie and other functions. If a user inputs his or her personal identification number, the system calculates the user's age, age of month and age level automatically.

Customer management handles user's information and nutrition history. This system makes use of a client's general information and initial anthropometry data. These data are used to all functions of system as basic input data. It is possible for the system to change user's information dynamically and to track the changes of accumulated data. This system is able to verify the user's nutrition history.

**3. Assessment of anthropometry and recommend energy**

The result items are standard weight, the range of standard weight, the rate to standard weight, Broca, Korean children

standard growth data, BMI, Rohrer, Kaup, Ponderal Index, the recommend energy of current weight, the recommend energy of standard weight and the recommend energy of age group. Obesity calculation makes the results based on the user's sex, weight, height and activities. The user sex is divided into man, woman, first half of pregnancy, second half of pregnancy and nursing. In standard weight case, if the user is under ten years of age, the system applies Korean children standard growth data. If the user is over ten years of age, the system applies Broca method. The final result be made as the user age group. Namely, BMI is the case that the user is over fifteen years of age, Rohrer is the case that the user is from three to fourteen years of age and Kaup is the case that the user is under two years of age. Besides, the system presents current user status comparing the results with criteria for judging. The Assessments of Kaup and Rohrer are functions which are not provided by any other system or software. This provides more various computation results than other software packages such as CAN, CAN Pro 2.0, CAFS2000, NACS2000 and FSM-21 with adding Rohrer, Kaup, Ponderal Index, etc. (Damoan Information Technoloy Corp. 2000 ; Han 1997a ; Lee and Nieman 2003 ; The Korean Dietetic Association 2000 ; The Korean Nutrition Information Center 2002). Three kinds of recommend energies are calculated as follows.

These calculations are processed by the following formulas :

Standard weight =  
 If height < 150 cm : (height - 100)  
 Else if height > = 150 cm and height < 160 cm : (height - 150) × 0.5 + 50  
 Else if height > = 160 cm : (height - 100) × 0.9

Range of standard weight =  
 90 - 110% of standard weight

Ratio of standard weight per current user's weight =  
 Standard Weight/Current User's Weight × 100(%)

BMI = weight (kg)/height (m) × height (m)

Rohrer = (height (g)/height (cm)<sup>3</sup>) × 10<sup>4</sup>

Kaup = (weight (g)/height (cm)<sup>2</sup>) × 10

Ponderal Index = height (inch)/cube root of weight (lb)

Recommend Energy of current Weight = Current Weight (kg) × Weight Value (kcal/kg) of user's age level

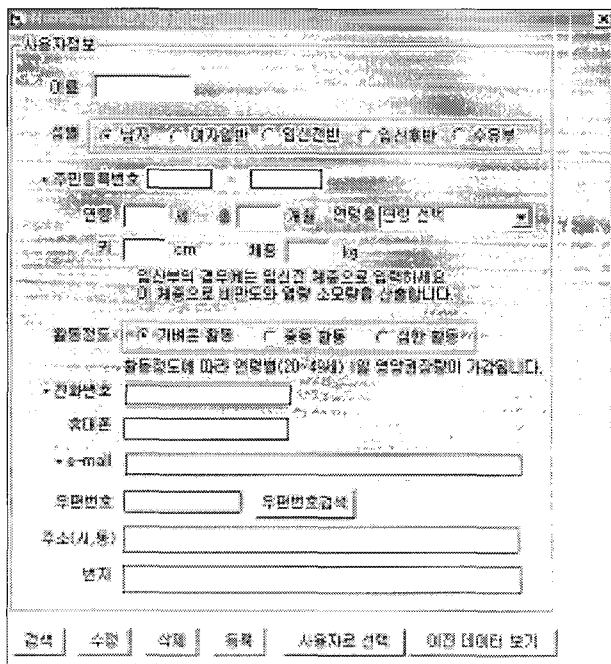


Fig. 2. The input screen of the client's information.

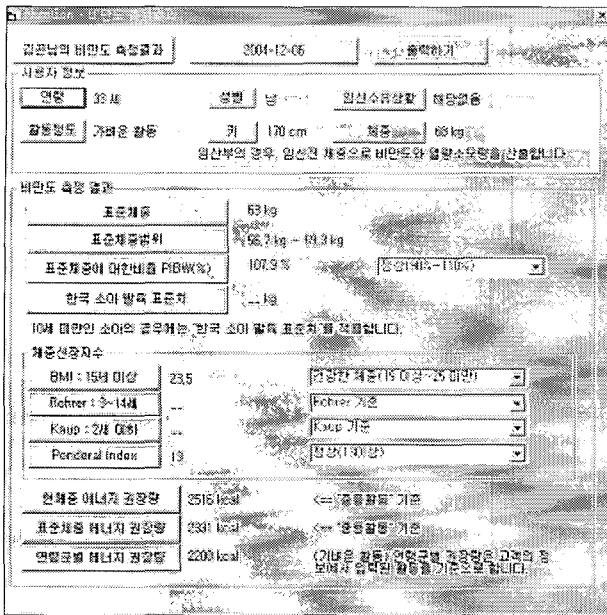


Fig. 3. The result screen of obesity calculation.

Recommend Energy of Standard Weight =  
 Standard Weight (kg) × Weight Value (kcal/kg) of user's  
 age level

Recommend Energy of Age Level = Recommend Weight  
 Value of a current user's age level

Obesity is currently an increasing disease that affects many countries in the world. According to Korean National Health and Nutrition Surveys, the prevalence of obesity in adults over 20 years of age has been rapidly increasing (Son et al. 2004). Obesity causes many health problems which have much concern and assignment to solve.

In this program, important obesity degree and assessment can be calculated depending on BMI, PIBW, Kaup, Rohrer, Ponderal Index and so on. And also it can calculate 3 kinds of recommend energy depending on situation. Therefore, 3 kinds of recommend energy can apply depending on weight control method efficiently.

4. Energy expenditure

This system accepts user's activity consumption time of ten kinds as a unit of hour or minute. And it computes a basal metabolic rate, calorie expenditure for activity, a specific dynamic action and total calorie expenditure (Hong 2004 ; Lee, Nieman 2003). In the computing process, the system makes the consumption time as a minute unit automatically and calculates total activity and sleeping hours. Besides, cal-

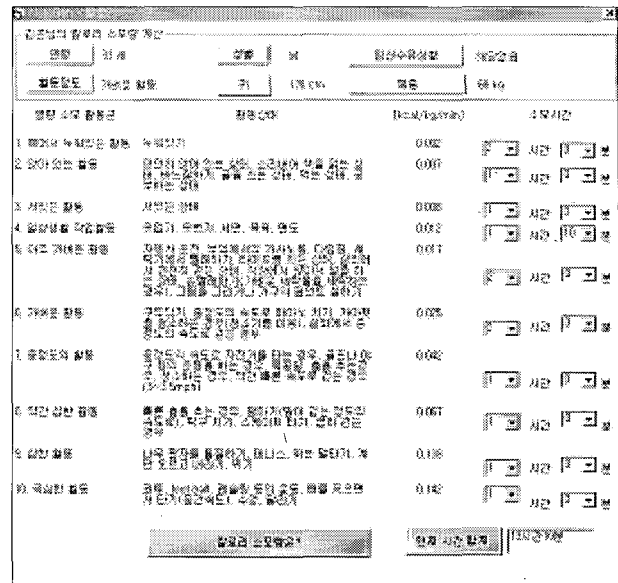


Fig. 4. The input screen of calorie expenditure.



Fig. 5. The result screen of calories expenditure.

culcation of semi-calorie expenditure makes the user's activity simple and provides general calorie expenditure.

Energy expenditure is processed by the following formulas :

Basal metabolic rate (A) :

$$\text{Male} = 1 (\text{kg}) \times \text{user's weight} \times 24$$

$$\text{Female} = 0.9 (\text{kg}) \times \text{user's weight} \times 24$$

Calorie expenditure for activity (B) :

$$= \text{Sum of used calories} \times \text{user's weight}$$

Specific dynamic action (C) :

$$= (\text{Basal metabolic rate (A)} + \text{Calorie expenditure for$$

$$\text{activity (B)} \times 0.1$$

Total calorie expenditure for a person :

$$= \text{Basal metabolic rate (A)} + \text{Calorie expenditure for activity (B)} + \text{Specific dynamic action (C)}$$

### 5. Convenient nutrition analysis and eating habit

#### 1) Convenient method for analysis of calorie and nutrients

This system makes use of a convenient method for analysis of calorie and nutrients. The semi-quantitative food intake method is developed by Moon (Moon et al. 1981) and is

used in various researches with some modification (Hong 2005). Fig. 6 shows the input screen of a convenient method for analysis of calorie and nutrients. In Fig. 6, intake food is divided into meat, milk, vegetable, fruit, cereals, sugar, fat and alcohol. Each food quantity is recorded to one precision. And this system includes alcoholism screening tests.

Fig. 7-9 show the result screens of convenient methods for analysis of calorie and nutrients. According to the user's input, this system separates food groups from meat, milk, vegetable, fruit, cereals, sugar, fat and alcohol. It calculates the nutrients of food group scores and total intake nutrients. It shows the calorie intake rates of nutrients and total calories.

Especially alcohol consumption is calculated in this program, because alcohol has an important role in the daily life of many healthy as well as sick individuals. Alcohol is regarded as empty calorie foods, containing 7kcal/g energy but lacking in other macro or micronutrients. It is known that alcohol represents a risk factor for overweight and obesity as a result of specific effects on energy metabolism (Suter 2004). Also, according to the user information, this system calculates recommend nutrition quantity as age group based on the user's current weight, standard weight and Korean recommend nutrient quantity. The nutrition rates are compared with intakes and presented as a percentage. Fig. 7-8 are the results of nutrition screening. Semi-nutrition screening is used in 'The Korean Society of Community Nutrition DIETNET (<http://www.dietnet.or.kr>)'. But, this system added new functions ; alcoholism screening tests and calculates the scores of food group and calorie rates of intake nutrients. Also, comparing food intakes and recommend nutrition quantity, this is able to calculate the recommend calorie and protein quantity to the weight of age group based on current weight, standard

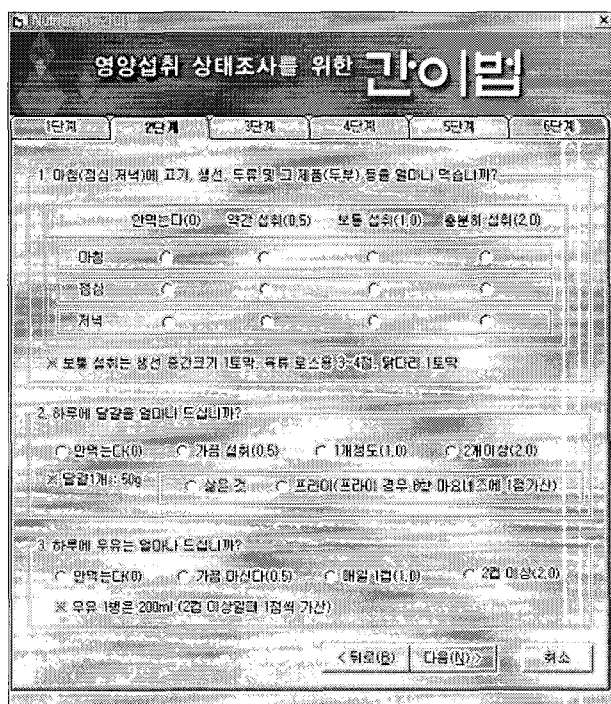


Fig. 6. The input screen of convenient method for analysis of calorie and nutrients.

사용자 정보		성별		나이		몸무게		신장	
성명	성별	나이	성별	나이	신장	몸무게	신장	몸무게	신장
김민	남	33 세	남	33 세	170 cm	68 kg	170 cm	68 kg	170 cm
2004-12-06	가계주 활동	가계주 활동	가계주 활동	가계주 활동	가계주 활동	가계주 활동	가계주 활동	가계주 활동	가계주 활동
당상부의 경우, 임신전 체중으로 비만도와 영양소요량을 산출합니다.									
영양분석		영양구분비				영양소, 에너지 섭취 요약			
식품군명	곡류	육류	채소류	과일류	유류	당류	유지방	알코올	합계
총에너지	4	2	4	1	1	2	1.5	10	26.5
단백질(g)	36	10	12	1	2	0	0	0	61
지방(g)	12	6	4	0.7	1	0	22.5	0	46.2
탄수화물(g)	12	15	26	19	17	40	0	0	132
칼슘(mg)	7.2	0.4	2.52	1	0.25	0	0	0	15.37
인(mg)	440	190	220	30	27	0	0	0	947
칼륨(mg)	206	220	300	27	0	0	0	0	753
비타민 A(μg)	242.4	72.72	1200	35	0	0	0	0	1970.12
비타민 B1(mg)	0.4	0.02	0.44	0.07	0.02	0	0	0	1.01
비타민 B2(mg)	0.40	0.20	0.72	0.05	0.03	0	0	0	1.08
나이아신(mg)	3.30	0.32	4.20	0.9	0.25	0	0	0	15.75
비타민 C(mg)	0	4	12	35	0	0	0	0	171

Fig. 7. The result screen of nutrition screening : nutrition analysis.

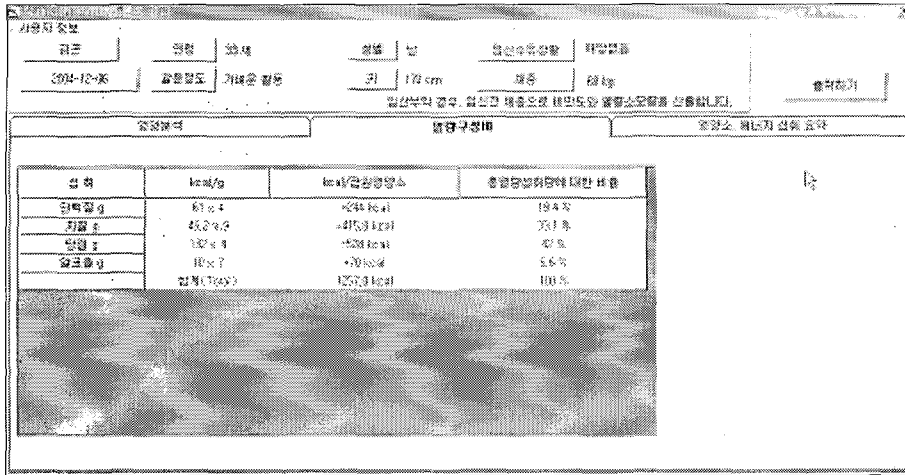


Fig. 8. The result screen of nutrition screening : calorie rate.

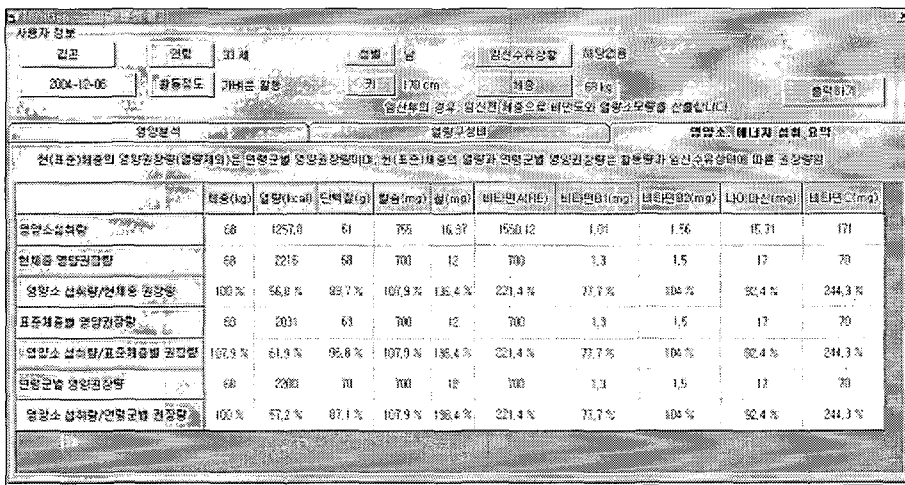


Fig. 9. The result screen of nutrition screening : ingestion of nutrition and energy.

weight, Korean nutrition recommend quantity. These added and detailed functions can make efficient nutrition counseling.

Fig. 8 shows calorie rate of main nutrition from the Fig. 7. In Fig. 9, 1) Nutrition intake is a result of user answer. 2) Recommend calorie of current weight is based on user's current weight. 3) Recommend calorie per standard weight is calculated from the standard weight with user's age level, height, weight and activity. 4) Recommend calorie per age level is derived from the age level which user is included.

2) Eating habits

There are 2 kinds of eating habits assessment. Fig. 10 shows result screen of eating habits. It has ten kinds of test items. Verifying how many ingest days in a week makes the result. Fig. 11 is an another eating habit self-test. It is developed to prevent the hyperlipidemia (Committee for Establishment of Hyperlipidemia 1996). It divides the user's eating habits into sixteen items and analyzes the input. This system can store the results and confirm in real time. The analysis results can be

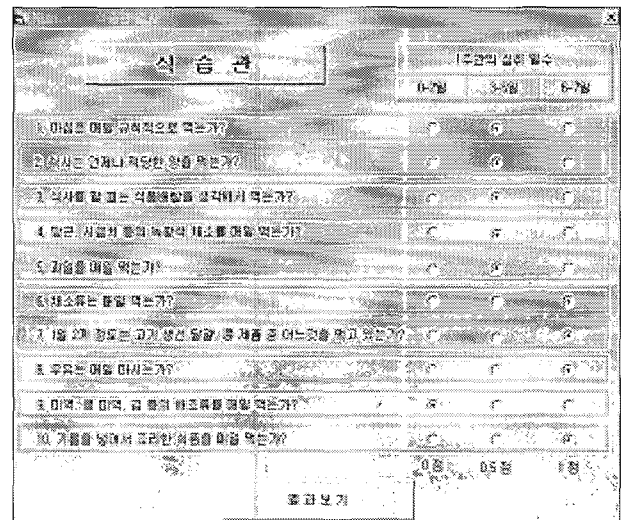


Fig. 10. The input screen of eating habits.

used as validation data for the improvement of users' eating habits. In Fig. 10, each question has a value : 1) 0 - 2 days is zero point, 2) 3 - 5 days is a half point, 3) 6 - 7 days is 1



Fig. 11. The input screen of eating habits self-test.

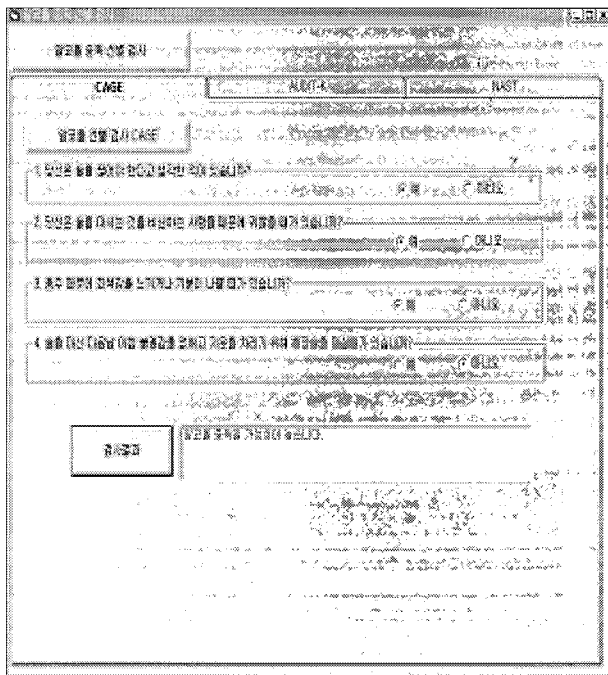


Fig. 12. CAGE (Cutting, Annoyance by criticism, Guilty Feeling, Eye-Opener) screen.

point. The degree is a sum of these points. In Fig. 11, The self-test has sixteen questions. Each question has three items. The values of items are different, but they are from 1 to 3.

**5. Alcoholism screening**

According to the report on National Health and Nutrition Survey (NHNS) in Korea, the drinking population has increased and everyday drinking population also increased from 6.0% to 9.3% of males aged 20 – 59 (Nam et al. 2000 ; Ko-

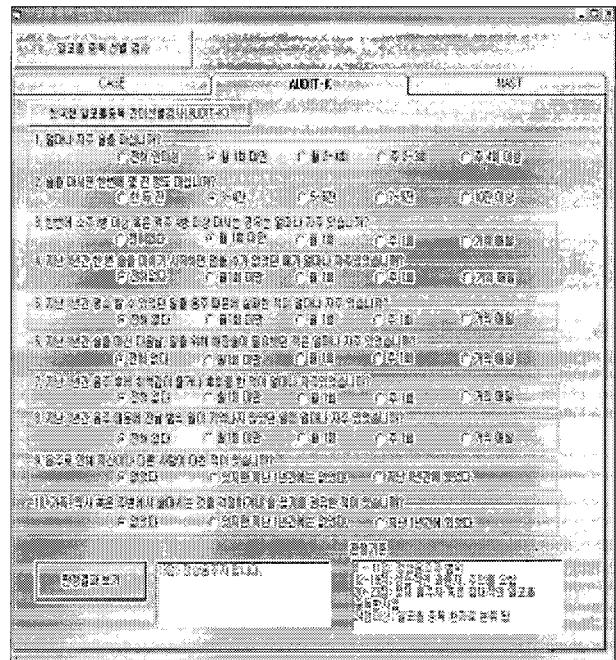


Fig. 13. NAST (National Alcoholism Screening Test) screen.

rea National Statistical Office 2003). Son et al. (2004) reported that men consuming moderate alcohol showed higher energy, fat, vitamin B groups than the ones consuming less than 24g alcohol/day. Heavy drinking men reporting more than 48g alcohol/day revealed 3207.2kcal of energy intake (130% of Korean RDA) and significantly elevated levels in most nutrients. Women drinkers showed similar patterns in nutrient intakes by alcohol consumption status to men. Alcohol is a nutrient, a psycho-active drug and a toxin (Suter 2004). Because of alcohol's characteristics, it is very important to screen alcoholism for nutrition counseling. Alcoholism screening is very important for nutrition counseling to control calorie intake, recommend to increase intake special nutrients and to reduce alcohol related problems such as obesity, fatty liver, hyperlipidemia, stroke and so on. In this program, alcoholism screening tests have the following three sub tests (Fig. 11–13).

- 1) CAGE screen ; Cutting, Annoyance by criticism, Guilty Feeling, Eye-opener (Ewing J 1984).
- 2) NAST ; National Alcoholism Screening Test (Kim et al. 1991).
- 3) AUDIT-K ; Alcohol Use Disorders Identification Test-Korean (Barbor et al. 1989 ; Son et al. 2002).

**6. Nutrition prescription and print**

This system can prints the results of each test and the out-



put of all tests. Also, the counselor can add their relevant nutrition prescription of each test and make the synthetic nutrition prescription of all tests.

### Summary and Conclusion

Several studies on nutrition counseling and screening have been accomplished till now. However, there are few research focuses on the system that provides synthetic nutrition counseling and screening for users and experts.

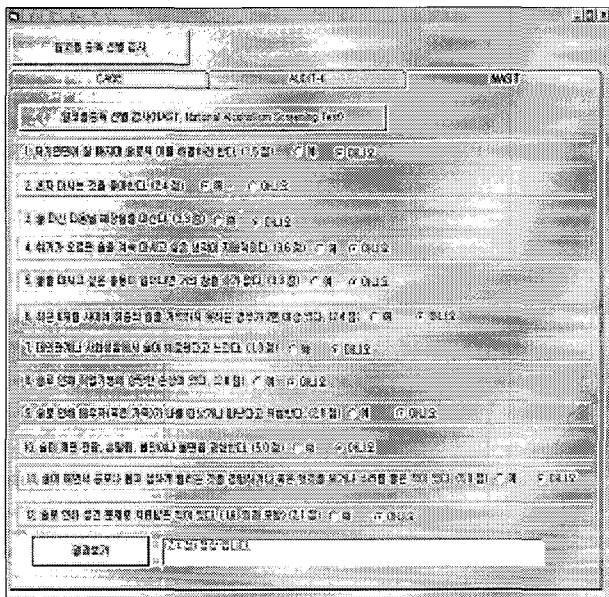


Fig. 14. AUDIT-K(Alcohol Use Disorders Identification Test-Korea) screen.

So, in this paper, we propose the improved nutrition counseling and screening system that complements the lack of previous researches. This system is able to make a more convenient user interface and the synthetic counseling results of various functions.

The nutrition counseling and screening system is composed of 1) general information, 2) anthropometry data, 3) computation of calorie expenditure (direct and indirect), 4) food intake (convenient method for analysis of calorie and nutrients, eating habits, eating habit self-test), 5) alcoholism screening tests, 6) print and database management. These functions are interoperated. Nutrition stores the users' information and manages their historical data. Because the system can input, store and print the user's data synthetically, it is able to make more efficient and timely counseling.

This system gathers various information of the client. And it is able to make nutrition education and counseling for clients. It provides friendly user interface and manages users' information using a database. So, this system is able to manipulate the systematic and formal user information. Also, it is able to provide information retrieval and nutrition counseling in real time. This system will make a contribution to national health improvement with active nutrition counseling.

Future work will include 1) adding various data of nutrition screening and criteria for judging, 2) making the tracking of client information, 3) analyzing and comparing of food ingested all day long, 4) menu planning using user information, 5) menu recommending as user properties and nutrition



Fig. 15. The output screen.

prescriptions.

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