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## Healthy Eating Knowledge among College Students in Muscat: A Self Reported Survey

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**Abstract:** This study was conducted to investigate the knowledge in healthy diet among the students of ten colleges in Muscat, Oman using questionnaire with 23 questions in terms of diet and health. Students from 10 colleges (1191 undergraduate students: 524 males and 667 females) participated in this study. About 94% of participated college students believed that there is a relationship between diet and health. Based on this self-reported survey, 70% of the students had little or no knowledge about high and low calorie foods. The health benefits of whole grain products were known to 70% of the students. About 51% of the students had good knowledge in protein rich foods and 54% of students had understood the importance of the consumption of fruits and vegetables. However, only 43 and 39% of students were aware of the unhealthy effects of higher consumption of salt and sugar, respectively. Based on our study, it shows that the knowledge about good and bad fats among these ten college students in Muscat is less. Only 15, 25, 27 and 18%, of the students had good knowledge in limit for daily intake of total fat, unhealthy effects of trans-fat, unhealthy effects of saturated fat and healthy effects of unsaturated fat, respectively. However, more than 90% of the students participated in this study were interested to learn about healthy diet and change their eating behavior. In general, whole grain benefits were known to the highest number of students and healthy effects of unsaturated fat and unhealthy effects of saturated fat were known to the least number of students. As this survey was conducted only in selected colleges and the outcome is based on the self-reported level of healthy diet knowledge, it may not be a strict indicator on the actual level of knowledge; however, it may be used as a broader guideline. Further intensive studies in this area are needed across the country.

**Key words:** Whole grains, saturated fat, dietary habit, healthy diet, Muscat

### INTRODUCTION

Healthy diet and adequate physical activity are essential elements for the promotion and maintenance of good health (WHO, 2010a). Coronary heart disease, some types of cancer, stroke, hypertension, obesity and type 2 diabetes are the major diseases in which diet plays a major role (Ammerman *et al.*, 2002; Pignone *et al.*, 2003; Khan, 2012; Olokoba *et al.*, 2012). Diet related diseases are increasing globally including Oman. According to World Health Organization (2010b), non-communicable diseases cause most deaths (83%) among adults and cardiovascular diseases are the leading cause of mortality in Oman (WHO, 2010b). The prevalence of diabetes and hypertension is 11.6 and 35.7%, respectively (WHO, 2010b). The number of diabetic patients in Oman is projected to increase by more than 200% in 2030 compared to 2000 (113,000-343,000) (WHO, 2010c).

Nutrition knowledge is an important factor in explaining variations in food choice (Fitzgibbon *et al.*, 2007; Wardle *et al.*, 2000). It is essential to assess the nutrition

knowledge level of people at different sector to incorporate new information to make the learning effective and useful (Wagoner *et al.*, 2004). Knowledge about healthy diet, interests to learn the scientific evidences and the willingness and attitude to follow healthy eating behavior are the stages toward healthy diet life-style. The knowledge in healthy diet can positively influence healthy eating and better informed people are more likely to adopt healthier diets (Henson *et al.*, 2010). There is a positive relationship between children's dietary food intake with the mother's nutritional knowledge and attitude (Al-Shookri *et al.*, 2011).

Information available on knowledge in healthy diet in developing countries including Oman is very limited. It is essential to characterize knowledge, attitude and interests about healthy diet among different sectors of people across the country to develop knowledge baseline. This information could be effectively utilized for strategic planning in developing policies and programs for promoting healthy eating behavior. The objective of

this study was to investigate the knowledge in healthy diet among the students of ten colleges in Muscat, capital city of Oman.

Although published work on awareness about healthy diet among the people of Oman or other Arab countries is limited, food consumption pattern has been well-reported by several researchers (Al-Shookri *et al.*, 2011; Musaiger, 1996; Musaiger, 1995a; Musaiger, 1995b). People in Gulf countries are undergoing a major change in their life-style (Kamran *et al.*, 2007). The trends in food consumption of adolescent girls and mothers of Oman are in the direction of unhealthier eating habits such as foods rich in fat, cholesterol, refined sugar and salt (Musaiger, 1996). In Bahrain, about 80-82% of the girls consume rice for lunch and 50-57% of the girls drink carbonated beverages (Musaiger, 1995b). Unbalanced diet with unhealthy life-style contributed for poor health and increased incidence of diet-related non-communicable diseases in Kuwait (Musaiger, 1995c). Similarly, the food consumption pattern in Saudi Arabia has dramatically changed and affected health and nutritional status of the community (Madani, 1995). In United Arab Emirates, relatively high percentage of university girl students are not consuming or rarely consume nutritious foods (Ministry of Health, 1995).

The objective of this study was to know the knowledge in healthy eating among ten college students in Muscat, Oman.

## MATERIALS AND METHODS

**Survey instrument:** The Omani guide to healthy eating was published by the Department of Nutrition, Ministry of Health in 2009 (Ministry of Health, 2009). This guide was mainly targeted to the educators and field health workers as reference for developing training materials and to assist in counseling and education activities. A questionnaire with 23 questions was designed and developed based on the Omani guide to healthy eating. In the first section, there were six questions (1-6) to collect demographic information such as age, gender, college, department, year in program and native place (home town). The second section (question 7-22), contained healthy diet components and it was divided into eight concepts. As the objective was to investigate the basic knowledge about the concepts of healthy diet, the questions were kept general (not specific to any disease) and simple. The details of the questions in this section are given in Table 1. For each question in this section, the students were asked to select any one of the three options: "Good-knowledge" / "little-knowledge" / "No-knowledge". The third section (question 23) contained an open ended question. The students were asked to write "any other comments on healthy diet." All questions were given in English and Arabic. The survey questionnaire

Table 1: Healthy diet concepts and questions used in the questionnaire

Concept	Questions
General belief and calorie	General belief about relationship between food we eat and our health Knowledge in calorie requirement for different age groups and activity level of people Knowledge in high and low calorie food
Carbohydrate	Knowledge about health benefits of whole grain products over white or refined grain products? Knowledge about glycemic index
Fat	Knowledge about the limit for maximum daily intake of fat Knowledge about trans-fat and its unhealthy effects Knowledge about saturated fat and its unhealthy effects Knowledge about beneficial effects of unsaturated fat (mono and poly)
Protein	Knowledge about protein rich foods and their importance in health
Minor nutrients	Knowledge about the importance of minerals and vitamins in health and their daily requirement
Fruits and vegetables	Knowledge about the need for high intake of fruits and vegetables
Salt and sugar	Knowledge about unhealthy effects of high intake of salt and daily maximum limit Knowledge about unhealthy effects of high intake of added sugar
Willingness to learn and change	Interests to learn about healthy diet Willingness to change eating habits toward healthy food

Table 2: Characteristics of the participants in the study

College	No. of participants	Male:Female	Age
College of Agricultural and Marine Sciences	133	44:56	22 <sup>±</sup> 1*
College of Engineering	102	87:13	22 <sup>±</sup> 2
College of Education	111	60:40	36 <sup>±</sup> 5
Caledonian College of Engineering	149	60:40	21 <sup>±</sup> 3
Waljat Colleges of Applied Sciences	105	40:60	20 <sup>±</sup> 3
Middle East College of Information Technology	118	35:65	20 <sup>±</sup> 2
Scientific College of Design	151	13:87	21 <sup>±</sup> 2
Mazoon University College	115	1:99	21 <sup>±</sup> 3
International Maritime College of Oman	102	53:47	20 <sup>±</sup> 2
International College of Engineering and Management	105	62:38	22 <sup>±</sup> 3
Total	1191	44:56	22 <sup>±</sup> 5

\*Mean, \*Standard deviation

was pilot tested with 10 students for clarity and comprehension and changes were carried out in appropriate places. This study was approved by the Department of Academic Affairs at Sultan Qaboos University (SQU) (Date of Approval: April 10, 2010).

**Participants:** Muscat is the capital of Oman and more than 25% of the nation's population lives here. Two universities and 15 colleges are located in Muscat due to various facilities along with density of population (Directorate of Private Universities and Colleges, 2007). In this study, 1191 undergraduate students from 10 colleges (3 colleges at SQU+7 private colleges) participated (Table 2). The students were explained the study details and the questionnaires were distributed in the class rooms. The students took 10-15 min to complete this survey.

**Data analysis:** Students had come from nine different regions of Oman, however, the representation for each region was uneven. Therefore, it was grouped into two categories ("Muscat" and "other regions") for statistical analysis. Similarly, the year in program was grouped into two categories such as junior (year 1 and 2) and senior (year 3 and above) students. For each healthy diet concept, the overall percentage of responses in terms of "good-knowledge," "little-knowledge," and "no-knowledge," was determined. Multiple logistic regression was used to study the effect of gender (male and female), native place (Muscat and other regions) and year in program (junior and senior) on awareness level using Statistical Analysis System software (SAS, version 8.02, SAS Institute, Inc., Cary, NC, USA).

## RESULTS AND DISCUSSION

Institutions had significant variations in the reported student's knowledge level about healthy diet. The knowledge level in each concept of healthy diet varied randomly among different institutions. There were no differences in knowledge level between male and female students in any of the tested healthy diet concept.

**General belief and calorie:** Based on our study, most of the students believed that there is a relationship between food and health. However, only 28-30% of the students reported that they had good knowledge in knowing low and high calorie foods and being aware of calorie requirement for people in different stage of life (Fig. 1). Junior students indicated to know more about the calorie requirement for different age group and activity level of people. In general, students living in Muscat area like to eat outside restaurants and fast food outlets. However, the students who are living in hostels with cooking facilities might have known a little more about the diet and its influence

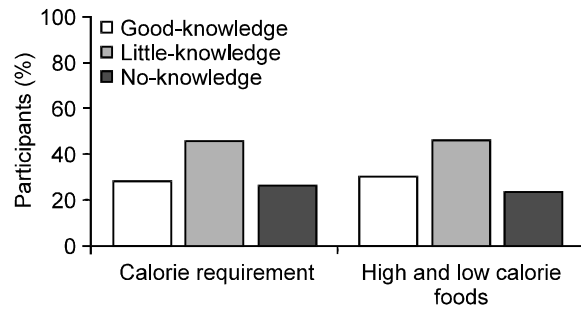


Fig. 1: Awareness about calorie concept and high and low calorie foods

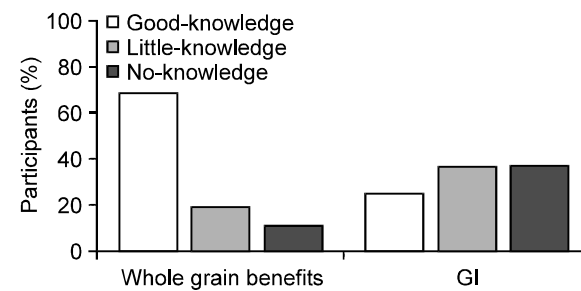


Fig. 2: Awareness about health effects of carbohydrate

on health than those who are eating in restaurants. Knowledge about high and low calorie foods is essential in selection of healthy food. The students should be educated on the calorie concept and different types of high/low calorie foods selection.

**Carbohydrate:** Based on our study, around 70% of students had good knowledge about whole grain benefits (Fig. 2), however, only 25% knew well about glycemic index (GI). Education about GI would help the students to select foods, since low and high GI labeled foods are available in super market. In general, men and women have different opinions in characterizing food in terms of health were documented (Wandel and Fagerli, 1999). For example, female students in Oklahoma State University differed significantly from male students with their concern of food labels, diet, health and nutrition, nutritional values, caloric content and appearance (Bryant *et al.*, 1995). In our study, there were no significant differences in frequencies of reported awareness of carbohydrate concepts between junior and senior students irrespective of their original regions.

**Fat:** Out of several healthy diet concepts, knowledge on "fat and health" was relatively low in our study population. Based on our data, only 15-27% of students had good knowledge about different components of fat concept (Fig. 3). Many students (42-55%) had no knowledge on the maximum intake of total fat/day and

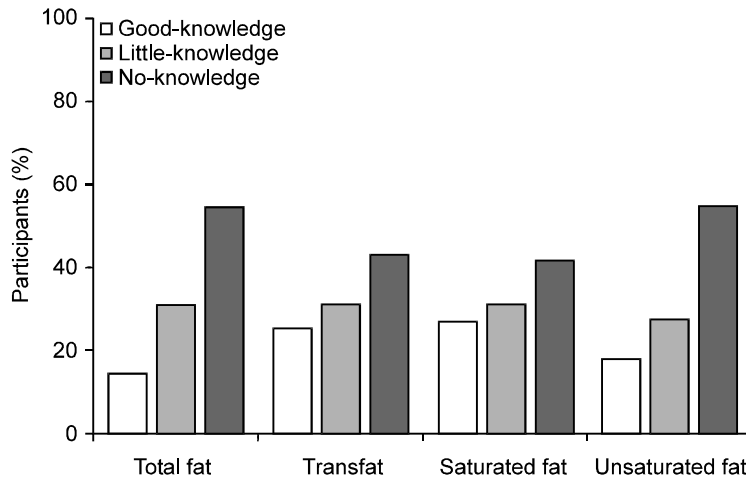


Fig. 3: Awareness about health effects of fat

effects of trans-fat/saturated fats and unsaturated fats on health. More senior students reported being aware of unhealthy effects of saturated fat than junior students. Students from other regions reported to know more about the health benefits of unsaturated fat than their counterparts.

It is important to educate the students on various aspects of fat as there are several traditional foods in Oman with high saturated fat. For example, halwa is a popular confection here and it contains around 10-15% of ghee. The saturated fat content of ghee is about 60-65%.

Bonanome and Grundy (1988) reported that most common saturated fat in Omani dishes are Myristic and palmitic acids. Musaiger *et al.* (1998) stated that the palmitic acid in Omani dishes exceeded 30 mg/100 g in 13 different dishes.

**Protein:** Our study results shows that around 50% of students reported to be aware about protein rich foods and protein requirement in a healthy diet (Fig. 4). Neither the year in program nor the native place had significant effect in student self-reported awareness of this concept. Musaiger (1995a) compared the food consumption pattern among the population in urban and rural areas of Bahrain. It was found that high protein foods such as meat were consumed by urban community, whereas rural population more likely consumed rice, bread, sugar and so on mainly due to the lower income.

**Micro nutrients:** The knowledge level of micro nutrients was almost similar to protein concept. About 50% of students had good knowledge about the need for micro nutrients (Fig. 5). There were no differences in micro nutrients knowledge level in year in program and native places groups.

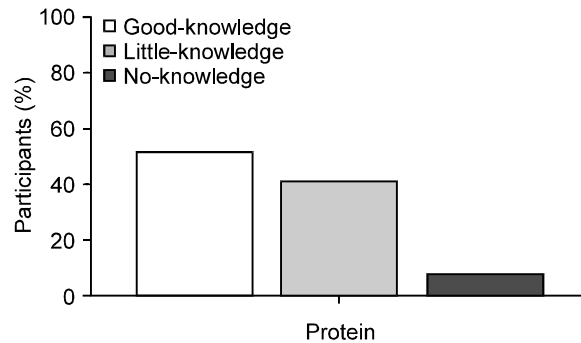


Fig. 4: Awareness about health benefits of protein

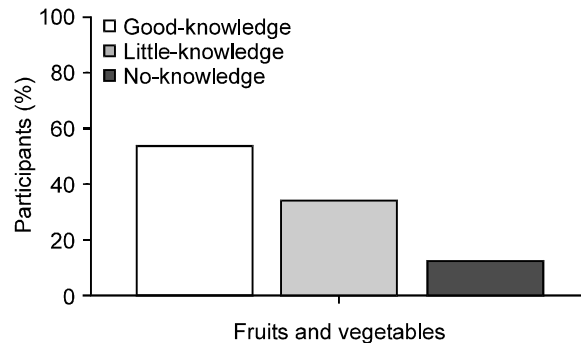


Fig. 5: Awareness about health benefits of minor nutrients

**Fruits and vegetables:** Our data shows that around 50% of the students had good knowledge about the importance of higher consumption of fruits and vegetables (Fig. 6).

Students should get educated about the need for higher servings of fruits and vegetables in daily menu. In a similar study conducted with Norwegians population, it was reported that 86% of the people viewed that vegetables are important in a healthy diet (Wandel and

Fagerli, 1999). Significant relationship was found between nutrition knowledge and fruits and vegetables intake (Wardle *et al.*, 2000; Henson and Blandon, 2010; Vriendt *et al.*, 2009).

**Salt and sugar:** Around 80% of students had good or little knowledge about the adverse health effects of higher consumption of added sugar and salt (Fig. 7). In Australia, 88% of participants were aware of the relationship between salt intake and high blood pressure and 69% reported reading the salt content of food products while shopping (Grimes *et al.*, 2009). Musaiger *et al.* (1998) reported that the sodium content of Omani dishes were in the range of 108-571 mg/100 g of food. It is necessary to educate the students about these concepts because many traditional Omani foods contained higher amount of salt and sugar.

**Willingness:** About 90% of the students showed interests (good or little) to learn more about healthy diet and change their eating habits (Fig. 8). Health food usage is mainly related to interests in healthy eating (WHO, 2010b). In our study, surprisingly, the willingness to change is higher (68%) than to learn (51%). This is probably due to student's assumption about the complex nature of the healthy diet concepts. This indicates the necessity for the development of simple and interesting materials to educate the students about healthy diet. Junior students expressed more interests to change their diet toward healthy eating than senior students.

**General comments:** About 15% of the participated students made additional remarks. All remarks were read and grouped into three categories based on the details: (a) Lack of availability of healthy food, (b) lack of knowledge about healthy food and (c) general comments. Lack of availability included comments like "college canteens do not sell healthy food," "healthy food is not available in the food court shops in the malls," "It is difficult to find out the restaurants where healthy food is served" and so on. We have recently reported that lack of availability was one of the main barriers for the consumption of healthy diet (Manickavasagan *et al.*, 2013). In lack of knowledge category, comments like "I do not know what is healthy?" and "I want to learn more about healthy diet before start planning my healthy eating behavior" have been noted. In the third category, all other general contents were grouped as general comments. In this group, there were lots of questions about genetically modifies foods, food safety issues and philosophical suggestions such as "life is very short and eat whatever you like." In each category the number of comments were counted and reported as percentage of comments in Fig. 9. Most of

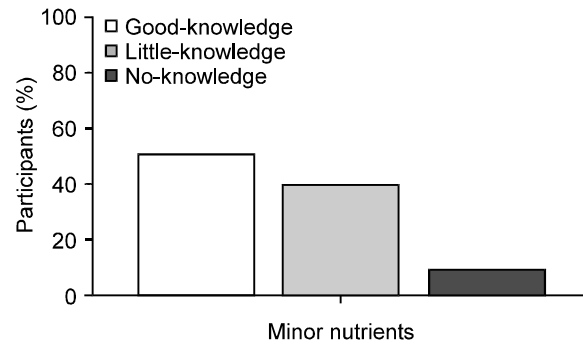


Fig. 6: Awareness about health benefits of fruits and vegetables

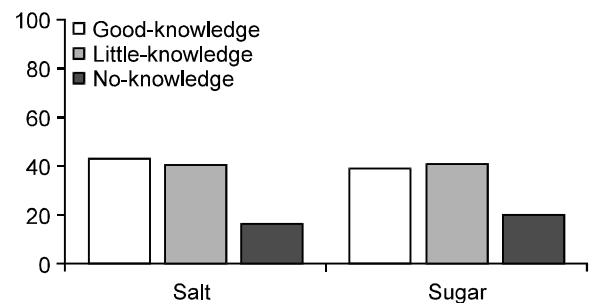


Fig. 7: Awareness about health effects of salt and sugar

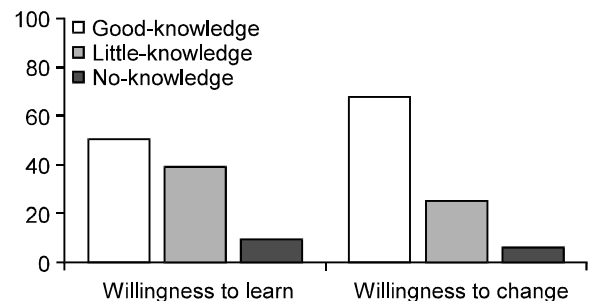


Fig. 8: Willingness to learn and change towards healthy diet

the comments given by our study participants confirmed that education might be needed about healthy diet. This is in alignment with the higher interests to learn and change the eating behavior (Fig. 8).

Food availability is one of the important factors that need to be considered while promoting healthy eating behavior because it plays a vital role in food selection. Specific knowledge assessment is warranted to understand the level of knowledge and thus determining the deficiency in practical knowledge about food sources and the relationship between diet and diseases. Higher education could be used as avenue to increase knowledge about healthy diet among college students in Oman and elsewhere by introducing compulsory courses that covers such an aspect of life-style factor.

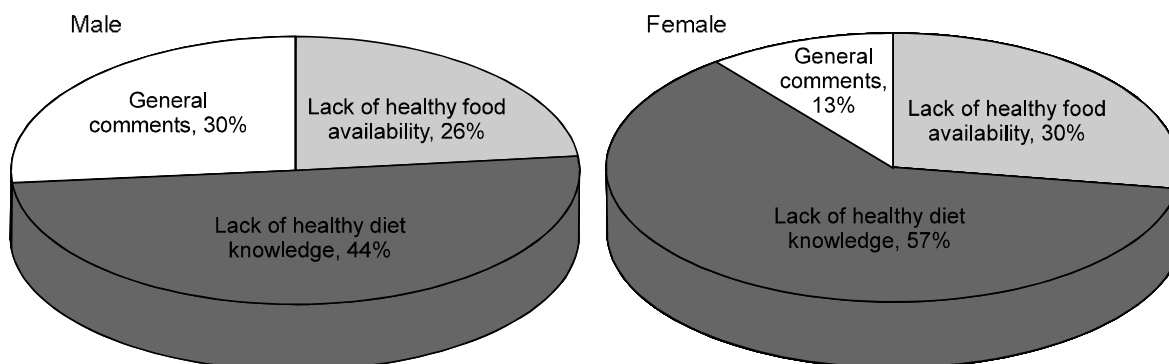


Fig. 9: Additional comments given by students

**Conclusion:** In general, the college students in Muscat, Oman had reasonable knowledge in different components of healthy diet except fat concept. They expressed interest to learn and change their behavior toward healthy diet. The dietary habit of these students is not measured in this study. The actual eating behavior must be studied in detail to get more information about consumption pattern of healthy diet. The knowledge level and eating behavior of overall population across the nation should be warranted to obtain more accurate information. The results presented in this paper are solely based on the self-reported survey from selected college students in Muscat. Therefore these data may not be the representative information for the college student's healthy diet knowledge in Oman.

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#### REFERENCES

Al-Shookri, A., L. Al-Shukaily, F. Hassan, S. Al-Sheraji and S. Al-Tobi, 2011. Effect of mothers nutritional knowledge and attitudes on Omani children's dietary intake. *Oman Med. J.*, 26: 253-257.

Ammerman, A., M. Pignone, L. Fernandez, K. Lohr, A.D. Jacobs and C. Nester, 2002. Counseling to Promote a Healthy Diet. Systematic Evidence Review No. 18 (Prepared by the RTI-University of North Carolina Evidence-based Practice Center under Contract No. 290-97-011). Rockville, MD: Agency for Healthcare Research and Quality. April 2002. Available from: <http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=hscps2ed1996&part=A15693>. [Last accessed on 2013 May 20].

Bonanome, A. and S.M. Grundy, 1988. Effect of dietary stearic acid on plasma cholesterol and lipoprotein levels. *N. Engl. J. Med.*, 318: 1244-1248.

Bryant, K.R., L.L. Ebro and W.D. Warde, 1995. Nutrition awareness and meat consumption of college students. *J. Am. Diet Assoc.*, 95: 54.

Directorate of Private Universities and Colleges, 2007. Private Higher Education Statistics. Muscat, Sultanate of Oman, p: 20-32.

Fitzgibbon, M., K.M. Gans, W.D. Evans, K. Viswanath, W.L. Johnson-Taylor, S.M. Krebs-Smith, A.B. Rodgers and A.L. Yaroch, 2007. Communicating healthy eating: Lessons learned and future directions. *J. Nutr. Edu. Behav.*, 39: 63-71.

Grimes, C.A., L.J. Riddell and C.A. Nowson, 2009. Consumer knowledge and attitudes to salt intake and labelled salt information. *Appetite*, 53: 189-94.

Henson, S., J. Blandon and J. Cranfield, 2010. Difficulty of healthy eating: A Rasch model approach. *Soc. Sci. Med.*, 70: 1574-80.

Kamran, S., A.B. Bener, D. Deleu, W. Khoja, M. Jumma, A. Al Shubali, J. Inshashi, I. Sharouqi and J. Al-Khabouri, 2007. The level of awareness of stroke risk factors and symptoms in the Gulf Cooperation Council countries: Gulf Cooperation Council stroke awareness study. *Neuroepidemiol.*, 29: 235-242.

Khan, M.U., 2012. Lifestyle modification in the prevention of type II diabetes mellitus. *Oman Med. J.*, 7: 170-1.

Madani, K.A., 1995. Food consumption patterns in Saudi Arabia. In: *Food Consumption Patterns and Dietary Habits in the Arab Countries of the Gulf*. Cairo, Egypt: FAO, p: 50-58.

Manickavasagan, A., G.R. Dubasi, M.S. Rahman and M.M. Essa, 2013. Informal group intervention technique to promote a healthy dietary habit in adults. *Int. J. Nut. Pharmacol. Neurol. Dis.*, 3: 24-28.

Ministry of Health, 1995. Food consumption pattern in UAE. In: *Food Consumption Patterns and Dietary Habits in the Arab Countries of the Gulf*. Cairo, Egypt, Egypt: FAO, p: 59-70.

Ministry of Health, 2009. The Omani Guide to Healthy Eating. Muscat, Sultanate of Oman: Department of Nutrition.

- Musaiger, A.O., 1996. Food habits of mothers and children in two regions of Oman. *Nut. Health*, 11: 29-48.
- Musaiger, A.O., 1995a. Socio-economic factors affecting per capita food consumption in Bahrain. In: *Food Consumption Patterns and Dietary Habits in the Arab Countries of the Gulf*. Cairo: FAO, p: 1-17.
- Musaiger, A.O., 1995b. Dietary habits of adolescent girls in Bahrain. In: *Food Consumption Patterns and Dietary Habits in the Arab Countries of the Gulf*. Cairo: FAO, p: 31-40.
- Musaiger, A.O., M.A. Ahmed and M.V. Rao, 1998. Chemical composition of some traditional dishes of Oman. *Food Chem.*, 61: 17-22.
- Musaiger, A.O., 1995c. Food habits in Kuwait. In: *Food Consumption Patterns and Dietary Habits in the Arab Countries of the Gulf*. Cairo, Egypt, FAO, p: 41-9.
- Olokoba, A.B., O.A. Obateru and L.B. Olokoba, 2012. Type 2 diabetes mellitus: A review of current trends. *Oman Med. J.*, 27: 269-73.
- Pignone, M.P., A. Ammerman, L. Fernandez, C.T. Orleans, N. Pender, S. Woolf, K.N. Lohr and S. Sutton, 2003. Counseling to promote a healthy diet in adults: A summary of the evidence for the U.S. preventive services task force. *Am. J. Prev. Med.*, 24: 75-92.
- Vriendt, T.D., C. Matthys, W. Verbeke, I. Pynaert and S.D. Henauw, 2009. Determinants of nutrition knowledge in young and middle-aged Belgian women and the association with their dietary behaviour. *Appetite*, 52: 788-92.
- Wagoner, D. and K. Wijekumar, 2004. Improving self-awareness of nutrition and lifestyle practices through on-line journaling. *J. Nut. Edu. Behav.*, 36: 211-2.
- Wandel, M. and R.A. Fagerli, 1999. Norwegians' opinions of a healthy diet in different stages of life. *J. Nut. Edu.*, 31: 339-46.
- Wardle, J. K., K. Parmenter and J. Waller, 2000. Nutrition knowledge and food intake. *Appetite*, 34: 269-275.
- WHO, 2010a. Global Strategy on diet, physical activity and health. Available from: <http://www.who.int/dietphysicalactivity/en>. [Last accessed on 2011 Jul 01].
- WHO, 2010b. Country Cooperation Strategy at a glance-Oman. Available from: [http://www.who.int/countryfocus/cooperation\\_strategy/ccsbrief\\_omn\\_en.pdf](http://www.who.int/countryfocus/cooperation_strategy/ccsbrief_omn_en.pdf). [Last accessed on 2012 Sep 18].
- WHO, 2010c. Diabetes Program: Facts and Figures South-East Asia Regions. Available from: [http://www.who.int/diabetes/facts/world\\_figures/en/index5.html](http://www.who.int/diabetes/facts/world_figures/en/index5.html). [Last accessed on 2011 Apr 30].