Global Journal of Health Science; Vol. 9, No. 2; 2017
ISSN 1916-9736 E-ISSN 1916-9744
Published by Canadian Center of Science and Education

Identifying and Prioritizing Educational Needs of Female Adolescents in Relation to Healthy Eating Based on Analytic Hierarchy Process Model

Saeed Mazloomi Mahmoodabad[1], Akram Mehrabbeyk[1], Hassan Mozaffari-Khosravi[2] & Hossein Fallahzadeh[3]

[1] Department of Health Services, Faculty of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

[2] Department of Nutrition, Faculty of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

[3] Department of Biostatistics, Faculty of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

Correspondence: Akram Mehrabbeyk, Department of Health Services, Faculty of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran. Tel: 98-35-3820-9100; 98-35-3820-9114. E-mail: mehrabbeyk@gmail.com

Received: May 1, 2016 Accepted: June 27, 2016 Online Published: July 6, 2016

doi:10.5539/gjhs.v9n2p223 URL: http://dx.doi.org/10.5539/gjhs.v9n2p223

Abstract

In order to better plan health based interventions, educators and health promoters need to make decisions in this regard. In the meantime, it should be noted that, multiple criteria decision making methods with theoretical roots and accuracy of forecasting results are less considered.

The current study is a descriptive research carried out on 15 experts working in Yazd Health Centers using purposeful sampling. In order to identify wrong eating habits of students, Delphi method is used. In the next step, these habits are compared, one by one, and scored with Analytical Hierarchy Process (AHP) Model. In the end, data are analyzed using Expert Choice 11 software.

Seven major wrong eating habits of female adolescents are identified: junk food consumption, drinking soda and sweet drinks, eating fast food, deleting main meals, improper diets, low intake of vegetables, and not eating breakfast. Among these, low intake of vegetables, eating fast food, and not eating breakfast, with weight rate of 32.4%, 19.4% and 19.3%, are specified as the first three priorities of education.

In various fields of education and health promotion, including prioritizing training needs, employing techniques with potentials of assessing multiple criteria at the same time can be highly efficient.

Keywords: female adolescents, healthy eating, analytical hierarchy process (AHP)

1. Introduction

After rapid growth during the first year, the fastest growth appears during adolescence which results in increased need for energy and nutrients. Failure to receive ideal diet during adolescence leads to slowed down the growth rate or even stops longitudinal growth. Also, eating well during this period plays a very important role in prevention of chronic disease including cardiovascular disease, cancer, and osteoporosis in adulthood (Story & Stang, 2005).

Indeed, adults' behaviors have their root in childhood and adolescence; thus, eating habits of early years of life are of great significance. According to existing literature, only 3.22% of adolescents use the recommended amounts of fruits and vegetables (Velazquez, Pasch, Ranjit, Mirchandani, & Hoelscher, 2011).

During the past two decades, snacks consumption (one of the high-calorie foods) between meals has been increased; adolescents, almost 3 times a day, and adults, almost 2 times a day, eat low nutritional value snacks (Cohen et al., 2012). Also, solid oils, fats, and sugars constitute a large amount of empty calories in new diets which accounts for 40% of energy consumed by adolescents (Reedy & Krebs-Smith, 2010).

According to the Centers for Disease Control in the United States, most of the adolescents' diet lacks recommended amounts of vegetables, fruits and grains and is rich in sodium, instead (Committee, 2010). 40% of calories for children and adolescents (2-18-years-old) come from nutrients like soda, pizza, desserts, fruit drinks, dairy desserts and whole milk. High calories beverages are also used more than milk by adolescents, on a daily

basis (Reedy & Krebs-Smith, 2010).

Bad diet among female adolescents, as future mothers, is worrisome (Banerjee et al., 2009). Living condition of these girls may change so fact since childhood to marriage and during pregnancy period which deprive them of educational opportunities. Since adolescence is the best time to create a series of behavioral patterns, dietary pattern of this period of life is of utmost importance (Merchant, 2014). A review of 23 studies on the impact of health education interventions in students' eating indicated that, in most cases, health education can positively influence students' knowledge as well as eating behaviors (18 studies on increasing knowledge and 15 studies on improving eating behavior); also, 8 studies have resulted in increased positive attitudes (Dehdari, Khezeli, Bakhtiyari, & Nilsaz, 2012).

With regard to upcoming requirements, in process of health education and promotion programs, health developers and trainers are forced to make a decision. In fact, the decisions play a significant role in selecting an educational program and a health-driven plan (Mohammadi, 2009).

According to studies conducted on health education and promotion studies in Iran, it is determined that, often, techniques such as Delphi method, nominal groups, and brainstorming are used for decision making while methods, like multi-criteria decision-making methods, grounded on theoretical and mathematical prediction accuracy, are less considered. One of these multiple criteria decision making method is Analytical Hierarchy Process (Taghdisi, Asadi, & Khoshdel, 2014)

Decision making with Analytical Hierarchy Process is developed by Thomas Saaty (1980) (Saaty, 1977).

Application of Analytic Hierarchy Process (AHP) in medicine indicates that AHP is an effective method to share decisions between doctor and patient. In addition, the method can evaluate different treatments to choose the best one. In health care sciences, AHP can improve health technology assessment and health policy-making In order to make decision by this approach the following steps are to be taken:

1) Define the problem and determine the information that is sought.

2) Structure the decision hierarchy in a way that the final objectives sit at the top. Then, secondary objectives, in terms of criteria, sit in the intermediate levels to the lowest level.

3) Set of pairwise comparison matrices in a way that each element in an upper level is used to compare the elements in the level immediately below.

4) Use the obtained priorities for weighing priorities of an immediately lower level and continue doing this to reach the lowest level.

To make comparisons, we need a scale of numbers that indicates how many times more important one element is over another element. The scale has 1-9 level in AHP process (Saaty, 2008). For the results to be valid, some degree of compatibility is necessary. This compatibility is determined by inconsistency rate and it has to be less than 0.1 (Saaty, 1980).

In the current study, the researcher is to prioritize educational needs of female adolescents in relation to healthy eating with an approach to AHP model.

2. Method

The current study is a descriptive research carried out on health experts of Yazd province on 2015. In the first place, 15 experts working in Yazd Health Centers are selected using purposeful sampling. Inclusion criteria are interacting with students, being aware of their dietary status, and willingness to participate. Delphi method was used to collect data. To do so, a questionnaire is delivered to each of the experts to list wrong eating habits, common among female adolescent, regardless of priority. After analyzing their comments, removing duplicates, a list of wrong eating habits of students is prepared. The habits are:

Junk food consumption, drinking soda and sweet drinks, eating fast food, deleting main meals, improper diets, low intake of vegetables, and not eating breakfast. Indeed, these behaviors are the same options preferred for AHP model. Then, after reviewing literature, three variables are used as comparison criteria of AHP model, i.e. severity, prevalence, and Changeability. (Didarloo, Shojaeezade, & mohammadian, 2014). Figure 1 depicts hierarchical structure of this study.

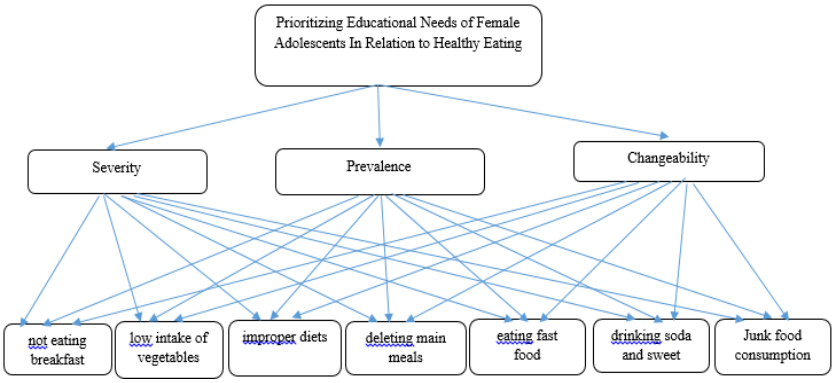

Figure 1. Hierarchical structure of the AHP model to prioritize educational needs of female adolescents in relation to healthy eating

In the second stage, questionnaires are revised and designed based on these criteria, and considering AHP model, then sent to experts. The experts are required to rank the eating habits, from 1 to 9, with respect to other habits and given criteria. Rating range is as follows:

Equal Importance	Moderate importance	Strong importance	Very strong or demonstrated importance	Extreme importance	Intermediate values between the two adjacent judgments
1	**3**	**5**	**7**	**9**	**2,4,6,8**

Figure 2. The Scale and Its Description

After completing the questionnaires, data are analyzed using Expert Choice 11 software.

3. Results

Information obtained from AHP analysis, divided by criteria, is summarized in tables. According to experts' comment, to design an educational intervention, Changeability of a wrong eating behavior is more important than its prevalence as well as severity of adverse effects on students' health (Table 1).

Table 1. Weight of each triple criterion

Criteria	Weight	Priority	Inconsistency Rate
Changeability	**65.3%**	**1**	
Severity	**28.5%**	**2**	**0.07**
Prevalence	**6.2%**	**3**	

Table 2. Severity-weight relation of each alternative

Alternative	Weight	Priority	Inconsistency Rate
Eating Fast Food	**0.479**	**1**	
Junk Food Consumption	**0.132**	**2**	
Drinking Soda and Sweet Drinks	**0.127**	**3**	
Low Intake of Vegetables	**0.106**	**4**	**0.09**
Deleting Main Meals	**0.071**	**5**	
Improper Diets	**0.057**	**6**	
Not Eating Breakfast	**0.027**	**7**	

According to obtained results, among common wrong eating habits of female adolescents, consumption of fast foods, soda, sweet drinks, and snacks, respectively, leave more adverse effects on students' health, than others (Table 2).

Also, among listed behaviors, low intake of vegetables, not eating breakfast, eating too much fast foods, respectively, are known to be used the most by the students (Table 3).

Table 3. Prevalence-weight relation of each alternative

Alternative	Weight	Priority	Inconsistency Rate
Low Intake of Vegetables	**0.429**	**1**	
Not Eating Breakfast	**0.216**	**2**	
Fast Food	**0.093**	**3**	
Deleting Main Meals	**0.085**	**4**	**0.09**
Junk Food Consumption	**0.078**	**5**	
Drinking Soda and Sweet Drinks Eating	**0.068**	**6**	
Improper Diets	**0.033**	**7**	

Finally, with regard to Changeability criteria and influenced by education, low intake of vegetables, not eating breakfast, high consumption of soda and sweet drinks, respectively, are identified as the most Changeable habits (Table 4).

Table 4. Changeability-weight relation of each alternative

Alternative	Weight	Priority	Inconsistency Rate
Low Intake of Vegetables	**0.392**	**1**	
Not Eating Breakfast	**0.250**	**2**	
Drinking Soda and Sweet Drinks	**0.114**	**3**	
Eating Fast Food	**0.100**	**4**	**0.07**
Deleting Main Meals	**0.057**	**5**	
Improper Diets	**0.053**	**6**	
Junk Food Consumption	**0.034**	**7**	

In the end, by taking all the three criteria into account simultaneously, the educational needs of students in relation to healthy eating are ranked as follows:

Table 5. Final weight of options with regard to all three criteria

Alternative	Weight	Priority	Inconsistency Rate
Low Intake of Vegetables	**0.324**	**1**	
Eating Fast Food	**0.194**	**2**	
Not Eating Breakfast	**0.193**	**3**	
Drinking Soda and Sweet Drinks	**0.114**	**4**	**0.09**
Deleting Main Meals	**0.062**	**5**	
Junk Food Consumption	**0.061**	**6**	
Improper Diets	**0.053**	**7**	

4. Discussion

Considering that identifying and prioritizing educational needs is the first step in training programs, in order to better organize the educational interventions, in this study we identified and prioritized the educational needs of female adolescents to improve their nutrition function. Among the studied criteria, to compare wrong eating

habits, flexibility, with total weight of 65.3%, is recognized as the most significant one. Due to the fact that the ultimate goal of educational intervention is to change eating behavior, it seems reasonable to always consider the level of flexibility of a habit as the most significant factor in training.

Based on the obtained results, educating the students about using vegetables owns the highest weight factor in the tables. Low intake of vegetables hits the first place with regard to both prevalence and flexibility criteria. According to CDC report, in 2010, the average fruit and vegetable consumption among high school students was 1.2 servings per day (Control & Prevention, 2011).

Mazloomi et al. showed that vegetable intake among university staff is lower than the recommended amount (Mazloomi, Fazelpour, & Askarshahi, 2013). Furthermore, according to previous studies, female students use less vegetables which indicates its prevalence among students (Heshmati, Behnampour, Homaei, & Khajavi, 2014; Yabandeh et al., 2014); however, educational interventions can increase the amount of vegetable intake among students (Abbasian et al., 2011).

Fast food consumption owns the second place in the table of educational needs. Adverse consequences arising from the consumption of these foods weighs more than other wrong eating habits severity criteria Researches have also mentioned adverse effects of fast food consumption on human health so that there is a strong positive correlation between eating fast food more than 3 times per week and respiratory problems of adolescents with 13-14 years of age (Ellwood et al., 2013). As proved in the study of Sanchez et al., those listed among top fast food users, are at the greater risk of depression (up to 40%); they found a significant relationship between amount of fast food intake and incidence of depression (Sánchez-Villegas et al., 2012). Trans fatty acids found in processed foods and fast food increase the risk of cardiovascular disease (Rubinstein et al., 2015). In another study conducted by Nazari et al., the researchers concluded that the content of trans fatty acids in Iranian processed foods is much higher than permitted amount (up to 2%) (Nazari et al., 2009). Reyhani et al. indicated that eating sausages and salami with high-fat dairy can increase the risk of breast cancer risk (Reyhani, Fahami, Mosharaf, & Tarkesh, 2012).

The third educational priority is training program about eating breakfast habit of students. This is a second priority behavior and is associated with prevalence and flexibility criteria. Although not having breakfast is in the last place in term of severity of adverse consequences, its importance is discussed in several studies. Because of having positive effects on appetite, hormonal and nervous signals, breakfast can control both appetite throughout a day and individuals weight (Leidy, Ortinau, Douglas, & Hoertel, 2013; Tin, Ho, Mak, Wan, & Lam, 2011). Studies have shown that students who eat breakfast do better than those who don't which is indicative of the importance of breakfast as a predictor of academic performance (Boschloo et al., 2012).

A Study on male students of elementary, guidance and high schools of Zahedan indicated that 2.5% of them never eat breakfast (Mortazavi & Roudbari, 2010). Also, a study on eating breakfast habit of elementary students of Qazvin indicated that 10.5 % of them go to school without eating breakfast (Rezakhani, Soheili Azad, Razaghi, & Nemati, 2012). Among female students of primary schools of Omidieh city, the rate increases to 20.5% (Karami & Ghaleh, 2015). Naeemi et al. studied male students of Qom and found that educational interventions can improve breakfast eating habit of these students (Shojaezadeh, Naeimi, Noori, Khalili, & Haghverdi, 2015)

5. Conclusion

According to this study, the most significant educational needs of female adolescent students of Yazd, in term of healthy eating, are as follows: low intake of vegetables, eating fast food, not eating breakfast, drinking soda and sweet drinks, deleting main meals, Junk food consumption and improper diets. It should be noted that, wrong eating habits of students described in this study are assessed with regard to the introduced criteria which may change if different set of criteria be included in prioritizing.

Acknowledgements

This paper is taken from Ph.D thesis of Akram Mehrabbeyk. The authors wish to thank the respected experts of Health Department of Shahid Sadooghi University of Medical Sciences (Health center of Yazd province) and all those who aided the researchers in implementing this project.

Competing Interests Statement

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

Abbasian, F., Omidvar, N., Bondarianzadeh, D., Rashidkhani, B., Shakibazadeh, E., & Hashemi, B. (2011). Effect of a School-based Intervention Based on Social Cognitive Theory on Fruit and Vegetable Consumption in

Middle School Students in Tehran. *Hayat, 17*(4), 73-84.

Banerjee, S., Chakrabarty, S., Vasulu, T., Bharati, S., Sinha, D., Banerjee, P., & Bharati, P. (2009). Growth and nutritional status of Bengali adolescent girls. *The Indian Journal of Pediatrics, 76*(4), 391-399. http://dx.doi.org/10.1007/s12098-009-0015-3

Boschloo, A., Ouwehand, C., Dekker, S., Lee, N., De Groot, R., Krabbendam, L., & Jolles, J. (2012). The relation between breakfast skipping and school performance in adolescents. *Mind, Brain, and Education, 6*(2), 81-88. http://dx.doi.org/10.1111/j.1751-228X.2012.01138.x

Cohen, D. A., Ghosh-Dastidar, B., Beckman, R., Lytle, L., Elder, J., Pereira, M. A., ... Conway, T. L. (2012). Adolescent girls' most common source of junk food away from home. *Health & Place, 18*(5), 963-970. http://dx.doi.org/10.1016/j.healthplace.2012.06.011

Committee, D. G. A. (2010). Report of the dietary guidelines advisory committee on the dietary guidelines for Americans, 2010, to the Secretary of Agriculture and the Secretary of Health and Human Services. *Agricultural Research Service.*

Control, C. F. D., & Prevention. (2011). Fruit and vegetable consumption among high school students--United States, 2010. MMWR. *Morbidity and Mortality Weekly Report, 60*(46), 1583.

Dehdari, T., Khezeli, M., Bakhtiyari, M., & Nilsaz, M. (2012). *Health Education Interventions on Student Nutrition: A Systematic Review.*

Didarloo, A., Shojaeezade, D., & mohammadian, H. (2014). *Health promotion planning* (pp. 154-155). Tehran: Sobhan

Ellwood, P., Asher, M. I., García-Marcos, L., Williams, H., Keil, U., Robertson, C., ... Asher, M. (2013). *Do fast foods cause asthma, rhinoconjunctivitis and eczema? Global findings from the International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three*. Thorax, thoraxjnl-2012-202285. http://dx.doi.org/10.1136/thoraxjnl-2012-202285

Heshmati, H., Behnampour, N., Homaei, E., & Khajavi, S. (2014). Predictors of fruit and vegetable consumption among female high school students based on PRECEDE model. *Iranian Journal of Health Education and Health Promotion, 1*(4), 5-14.

Karami, K., & Ghaleh, S. (2015). Breakfast and snack patterns of primary school girls in Omidieh, Khuzestan Province, Iran. *Journal of Preventive Medicine, 2*(3), 0-0.

Leidy, H. J., Ortinau, L. C., Douglas, S. M., & Hoertel, H. A. (2013). Beneficial effects of a higher-protein breakfast on the appetitive, hormonal, and neural signals controlling energy intake regulation in overweight/obese,"breakfast-skipping," late-adolescent girls. *The American Journal of Clinical Nutrition, 97*(4), 677-688. http://dx.doi.org/10.3945/ajcn.112.053116

Liberatore, M. J., & Nydick, R. L. (2008). The analytic hierarchy process in medical and health care decision making: A literature review. *European Journal of Operational Research, 189*(1), 194-207. http://dx.doi.org/10.1016/j.ejor.2007.05.001

Mazloomi, M. S., Fazelpour, S., & Askarshahi, M. (2013). *Health-Promoting Behaviors and Psychosocial Well-Being of University Shahid Sadoqi Yazd Academic Staff in Iran.*

Merchant, K. M. (2014). Women's Nutrition Through the Life Cycle. *Women in the Third World: An Encyclopedia of Contemporary Issues, 165*.

Mohammadi, D. (2009). *Principles of organization, management and supervision* (1st ed., pp. 210-211). Tehran: Aeeizh.

Mortazavi, Z., & Roudbari, M. (2010). Breakfast consumption and body mass index in primary, secondary and high school boys in Zahedan 2005-2006. *Iranian Journal of Endocrinology and Metabolism, 12*(4), Pe345-Pe351, En447.

Nazari, B., Asgary, S., Sarrafzadegan, N., Saberi, S., Azadbakht, L., & Esmaillzadeh, A. (2009). Evaluation of Types and Amounts of Fatty Acid Content in some most Consumed Iranian Fast Foods. *Journal of Isfahan Medical School, 27*(99).

Reedy, J., & Krebs-Smith, S. M. (2010). Dietary sources of energy, solid fats, and added sugars among children and adolescents in the United States. *Journal of the American Dietetic Association, 110*(10), 1477-1484. http://dx.doi.org/10.1016/j.jada.2010.07.010

Reyhani, M., Fahami, F., Mosharaf, S., & Tarkesh, N. (2012). The relationship between the amount of dairy products and animal proteins consumption and breast cancer in isfahani women. *ZUMS Journal, 20*(81), 45-54.

Rezakhani, H., Soheili Azad, A., Razaghi, M., & Nemati, A. (2012). Pattern of breakfast and snack consumption and their effective factors among primary school students, Qazvin. *Journal of Health, 2*(4), 57-63.

Rubinstein, A., Elorriaga, N., Garay, O. U., Poggio, R., Caporale, J., Matta, M. G., ... Mozaffarian, D. (2015). Eliminating artificial trans fatty acids in Argentina: Estimated effects on the burden of coronary heart disease and costs. *Bulletin of the World Health Organization, 93*(9), 614-622. http://dx.doi.org/10.2471/BLT.14.150516

Saaty, T. L. (1977). A scaling method for priorities in hierarchical structures. *Journal of Mathematical Psychology, 15*(3), 234-281. http://dx.doi.org/10.1016/0022-2496(77)90033-5

Saaty, T. L. (1980). *The analytic hierarchy process: planning, priority setting, resources allocation.* New York: McGraw.

Saaty, T. L. (2008). Decision making with the analytic hierarchy process. *International Journal of Services Sciences, 1*(1), 83-98. http://dx.doi.org/10.1504/IJSSCI.2008.017590

Sánchez-Villegas, A., Toledo, E., de Irala, J., Ruiz-Canela, M., Pla-Vidal, J., & Martínez-González, M. A. (2012). Fast-food and commercial baked goods consumption and the risk of depression. *Public Health Nutrition, 15*(03), 424-432. http://dx.doi.org/10.1017/S1368980011001856

Shojaezadeh, D., Naeimi, M., Noori, K., Khalili, Z., & Haghverdi, A. (2015). Survey of the Effect of Education Based on the Health Belief Model (HBM) on Knowledge, Perception and Performance about Having Breakfast of Primary School Student boys. *Journal of Health, 6*(2), 144-153.

Story, M., & Stang, J. (2005). Nutrition needs of adolescents. *Guidelines for adolescent nutrition services* (pp. 21-34). Minneapolis, MN: Centre for Leadership, Education and Training in Maternal and Child Nutrition Division of Epidemiology and Community Health, School of Public Health, University of Minnesota.

Taghdisi, M., Asadi, Z., & Khoshdel, A. (2014). Multi Criteria Decision Making Methods in Health Education and Promotion. *TOLOO-E-BEHDASHT, 13*(6), 82-92.

Tin, S., Ho, S., Mak, K., Wan, K., & Lam, T. (2011). Breakfast skipping and change in body mass index in young children. *International Journal of Obesity, 35*(7), 899-906. http://dx.doi.org/10.1038/ijo.2011.58

Velazquez, C. E., Pasch, K. E., Ranjit, N., Mirchandani, G., & Hoelscher, D. M. (2011). Are adolescents' perceptions of dietary practices associated with their dietary behaviors? *Journal of the American Dietetic Association, 111*(11), 1735-1740. http://dx.doi.org/10.1016/j.jada.2011.08.003

Yabandeh, A. P., Nejatizadeh, A., Mehrabani, H. H., Dabiri, F., Kamjoo, A., Shahi, A., & Rafat, F. (2014). Assessment of nutritional status, dietary habits and physical activity of adolescents in Bandar Abbas, Iran. *Bimonthly Journal of Hormozgan University of Medical Sciences, 17*(6), 455-463.