The effect of a nutrition education intervention on knowledge, attitude, and intake of foods high in fats in women

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Abstract:

BACKGROUND: Given that many Iranian were interested in the consumption of foods that are high in fats, the present study was done to determine the effect of a nutrition education intervention on knowledge, attitude, and intake of foods high in fat among a sample of women in Tehran.

MATERIALS AND METHODS: In this quasi-experimental study, 92 female referrals to the health houses affiliated to Tehran municipal were selected and assigned to either intervention (n = 46) or control (n = 46) groups. Information (data) regarding women’s knowledge, attitude, and practice in terms of foods rich in fat intake was collected by three questionnaires. Then, a nutrition education intervention included four 40–60 min training sessions over 4 weeks was designed and conducted to the study participants in the intervention group. Two groups were followed up 2 months after the intervention. Finally, all data were analyzed by using the independent-samples t-tests, Student’s paired-samples t-test, and Pearson correlation analysis on the R software (version 6.3.2).

RESULTS: The results showed that there were significant reductions in a positive attitude towards food with high fat content and intake of these foods in the intervention group compared with the control group after the intervention (P < 0.001). Furthermore, following the intervention, the intervention group reported a significant increase in dietary fat nutrition knowledge than the control group (P < 0.001).

Conclusion: Developing nutrition education interventions is an effective strategy for reducing the consumption of foods rich in fat in Iranian women.

Keywords:
Attitude, diet, health education, high-fat, knowledge

Background

Dietary fat, as one of the essential macronutrients, is found in most food groups. Foods containing fat generally provide a range of different saturated and unsaturated fatty acids.[1,2] Literature showed that a diet high in saturated fatty acids (SFAs) and trans fatty acids (TFAs) were associated with an increased risk of several chronic diseases such as cardiovascular.[3] All these fatty acids (except for stearic acid) may raise the level of total and low-density lipoprotein cholesterol.[4,5] Despite the complications of high-fat diet on human health,[3] there were high amounts of TFAs in popular foods in some countries[6] and many people, especially obese adults prefer foods high in fats.[7] The results of a study showed that there was a large amount of hydrogenated fats in Iranian traditional dietary pattern.[8] Eating patterns of this country might explain the higher prevalence of some cardiovascular risk factors in this country.[9] Globally,
multiple interventions in terms of decreasing high-fat diet intake have been done, however, some of the studies were not effective. Literature showed that performing interventions to lifestyle change of individuals for decreasing dietary SFAs and TFAs intake, and increasing poly-and monounsaturated fatty acids intake has beneficial effects on their lipid profile and health outcomes. Literature showed that implementing nutrition education intervention may improve lifestyle of individuals in terms of dietary intakes. Nutrition education interventions, as a potential tool to promote healthy eating patterns, may reduce fat intake in consumers. Considering that, when developing nutrition education interventions to reduce the consumption of foods high in fat, emphasis on individuals fat nutrition knowledge, and their attitudes towards high-fat diet are essential. Consumers with more nutritional knowledge may consume less unhealthy fats. Literature showed that knowledge of consumers regarding fatty acids and high-fat diet was not acceptable. For example, Valentin et al. reported that 39.7% of mothers know about the difference between saturated and unsaturated fats and only 16.4% of them were able to correctly differentiate hydrogenated from interesterified margarine. They concluded that the actual ability of mothers to identify foods by their fat content was low and developing maternal nutrition education programs in this field was necessary. Eckel et al. showed that Americans’ knowledge, especially regarding food sources of SFAs and TFAs was relatively low. They highlighted the need to further consumer education efforts in this issue.

Therefore, given the considerable prevalence of dyslipidemia and the important impact of dietary behaviors on abnormal blood lipids, developing interventions such as nutrition education interventions to reduce high-fat foods in Iran is imperative. The present study was conducted to examine the effect of a nutrition education intervention on knowledge, attitude, and intake of foods high in fat among a sample of women in Tehran.

Materials and Methods

This quasi-experimental study (IRCT code# IRCT20110727007132N19) was performed on 92 women referred to health houses in Tehran, Iran, during October and February 2020. The municipal of Tehran covers 354 health houses in various areas. The list of the health houses in the four regions including North, South, East, and West of Tehran city at the moment of the study was available to the researchers. One health home was randomly selected by simple random sampling method from each region. Then, among woman referred during a day to each health home, 23 women was selected by simple random sampling method. The first woman to visit of the health house was randomly assigned to the intervention group. The second person was randomly assigned to the control group. The third person was assigned to the intervention group. Similarly, the allocation of the remaining subjects was continued in two groups (intervention group = 46 and control group = 46). In the present study, the inclusion criteria were age between 19 and 65 years, elementary education level, and agreement to participate. The exclusion criteria included a history of chronic diseases that limit high-fatty foods consumption such as diabetes, cardiovascular disease, and current consumption of lipid-lowering medications. The study protocol was approved by the Ethics Committee of Iran University of Medical Sciences (IR.IUMS.REC.1397.1177). The researchers informed the participants about the purpose of the study. Participants completed written consent to participate in the study. None of the participants lost to follow-up. Finally, the data of 92 participants were analyzed [Figure 1].

In this study, four instruments were used to gathering the data. The first instrument was developed and validated by Venter to measuring knowledge of dietary fat. The instrument had two sections. We used the second section that had 18 multiple-choice items to measure dietary fat nutrition knowledge. The second instrument (with 15 items) was developed and validated by the Nutrition Working Group African Medical Association (dyslipidemia South) to assessing the intake of high-fat foods. The third instrument (with 5 items) was developed and validated by Roefs and Jansen to measure attitudes towards high-fat foods. In the instrument, the items were measured on a seven-point Likert scale [strongly agree to strongly disagree]. The fourth instrument was a researcher-made instrument for measuring demographic information of the participants. Then, the reliability and validity of the first three instruments were determined. The instruments were initially translated into Persian and re-translated into English. Then, the qualitative face validity of the instrument’s items was assessed on 20 women (excluding the studied samples). In this stage, according to their feedbacks, seven items were removed or edited. The validity of the instruments was measured by quantitative and qualitative content validity. Next, a panel of 10 experts in nutrition, cardiovascular, and health education reflected opinions about the content validity ratio (CVR) and content validity index (CVI) of the instrument items. Items with a CVI <0.79 and CVR <0.62 were removed of the instruments. In this stage, two items of the first instrument and five items of the second instrument were deleted. Furthermore, according to expert insights, some items of the instruments that its consumption in Iranian food culture had not popular were edited and changed
with popular food items. The test-retest correlation coefficients (with a 2-week interval between the tests) were measured by 20 women to estimate the stability of the first and second instruments. The estimate of test-retest correlation factor ≥0.61 was considered satisfactory.[28] The test-retest correlation coefficient for the first and the second instrument was 0.77 ($P = 0.002$) and 0.95 ($P = 0.002$), respectively. Cronbach’s alpha was used to investigate the internal consistency of the third instrument. Cronbach’s alpha coefficient ≥0.70 was considered satisfactory.[29] Cronbach’s alpha for this instrument was 0.70. At this stage, no items were removed from the instruments. The final instruments had 16 items to measure the participants’ knowledge in terms of dietary fat food, 5 items to measure attitude, and 15 items to measure the intake of high-fat foods.

The intervention designed for the intervention group consisted of four 60 min training sessions over four weeks (with an interval 7d between the sessions). The first training session was an introduction to food groups, dietary recommendations of fat intake, the diet-disease relationship, and the role of dietary behaviors, and consumption of foods rich in fat on hyperlipidemia (as a common risk factor to various chronic diseases). The second session focused on the types of fats and amounts of fat in foods, the quality of dietary fat, the types of foods rich in SFAs and TFAs, what types of fat to consume, and how much is appropriate. The third session was aimed at reducing the positive attitude of participants towards high-fat foods in the intervention group. In this session, participants were divided into small groups ($n = 7$). Each of them discussed their beliefs about dietary fat and low-fat alternatives, acceptance of reduced-fat foods, barriers to reducing dietary fat intake, and ways to overcome them. The fourth session focused on the effects of fat on odor and taste of food and the methods of reducing the amount of foods fat in the process of cooking or preparation without reducing odor and taste of it. In this session, participants shared their experiences in this field with other participants. Meanwhile, a complete list of the methods for reducing the amount of fat in foods was administered to the participants. During the four sessions, through verbal persuasions, women were encouraged to eating low-fat foods. In addition, two pamphlets about the types of fats and methods of reducing food fat without reducing its taste were given to participants. Participants in the control group were not received any education intervention. Two groups were followed up 2 months after the intervention and completed the instruments again.

The data were analyzed using the R software (version 6.3.2). Kolmogorov–Smirnov test was applied to assess the
normality of data. The results showed that knowledge, attitude, and intake of foods high in fats variables scores had normal distribution in the two groups. Differences in the total mean scores of knowledge, attitude, or intake of foods high in fats variables between the two groups before and after the intervention were tested using independent samples t-tests. Furthermore, paired samples t-test was used to assess the differences in the total mean scores of the participants’ knowledge, attitude, or high-fat foods intake variables in each group before and after the intervention. Correlations of high fat foods intake with knowledge and attitude in each group before and after the intervention were analyzed through the Pearson correlation analysis. The data were reported as frequency and mean ± standard deviation (SD). $P < 0.05$ was considered statistically significant in the study.

Results

The average age of participants in the intervention and control groups was 36.20 (SD = 1.28) and 38.65 years (SD = 1.17), respectively. Before the intervention, no significant differences were found between the two groups for any of the demographic characteristics, knowledge, attitude, and intake of foods high in fats variables. Other demographic characteristics of the two groups are shown in Table 1. The results showed that there were significant reductions in a positive attitude towards high fat foods and intake of foods high in fats variables in the intervention group compared with the control group after the intervention [Table 2]. In addition, following the intervention, the intervention group reported a significant increase in dietary fat nutrition knowledge compared with the control group [Table 2]. The relationship between high fat foods intake and knowledge or attitude towards food with a high fat content in both groups before and after the intervention is shown in Table 3. There was a significant relationship between attitudes towards high fat foods consumption and the intake of high fat foods in the intervention group before and after the intervention.

Discussion

The present study demonstrated that the effect of a nutrition education intervention on knowledge, attitude, and high fat foods intake among a sample of women in Tehran. The findings showed that the intake of high fat foods among the participants in the intervention group significantly decreased compared with the control group after the intervention. This finding is consistent with those of Kroeze et al.\[30\], Manios et al.\[31\] and Ahmad et al.\[32\]. Moreover, Abood et al. showed that implementing nutrition education intervention significantly decreased the intake of fat, saturated fat, and cholesterol to levels consistent with national recommendations among staff employees.\[33\] In line with our results, Pletzke et al. reported that nutrition education could decrease purchase foods containing TFAs among consumers.\[34\]

Table 1: Demographic characteristics of the participants in the intervention (n=46) and the control (n=46) groups

| Variables                 | Intervention group | Control group |
|---------------------------|--------------------|---------------|
| Age, mean±SD              | 36.2±1.28          | 38.6±1.17     |
| Number of children, mean±SD | 1.15±0.89         | 0.93±1.01     |
| Marital status, n (%)     |                    |               |
| Single                    | 11 (23.90)         | 12 (26.10)    |
| Married                   | 35 (76.10)         | 34 (73.90)    |
| Education level, n (%)    |                    |               |
| ≤ Diploma                 | 18 (39.50)         | 15 (32.60)    |
| Academic degree           | 28 (60.90)         | 31 (67.40)    |
| Occupation, n (%)         |                    |               |
| Employee                  | 14 (30.40)         | 20 (43.50)    |
| Self-employed             | 11 (23.90)         | 6 (13.00)     |
| Household duties          | 21 (45.70)         | 20 (43.50)    |

SD=Standard deviation

Table 2: Comparison of knowledge, attitude, and high-fat foods intake variables in the two groups before and after the intervention

| Variables                                      | Intervention group | Control group |
|------------------------------------------------|--------------------|---------------|
| Before the intervention                        | After the intervention |
|-before the intervention                        | After the intervention |
| Dietary fat nutrition knowledge                | 4.33±2.26          | 13.28±1.53    | <0.00001* |
| Attitude towards high-fat foods                | 21.43±3.23         | 10.57±3.35    | <0.00001* |
| High-fat foods intake                          | 47.93±8.85         | 21.50±3.99    | <0.00001* |
| Before the intervention                        | After the intervention |
| Dietary fat nutrition knowledge                | 4.22±2.44          | 4.39±2.62     | 0.59       | <0.00001* |
| Attitude towards high-fat foods                | 21.52±5.18         | 20.33±5.63    | 0.06       | <0.00001* |
| High-fat foods intake                          | 43.48±7.62         | 42.57±8.85    | 0.39       | <0.00001* |

| Variables                                      | Intervention group | Control group |
|------------------------------------------------|--------------------|---------------|
| Before the intervention                        | After the intervention |
|-Dietary fat nutrition knowledge                | 4.33±2.26          | 13.28±1.53    | <0.00001* |
| Attitude towards high-fat foods                | 21.43±3.23         | 10.57±3.35    | <0.00001* |
| High-fat foods intake                          | 47.93±8.85         | 21.50±3.99    | <0.00001* |

| Variables                                      | Intervention group | Control group |
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| Before the intervention                        | After the intervention |
| Dietary fat nutrition knowledge                | 4.22±2.44          | 4.39±2.62     | 0.59       | <0.00001* |
| Attitude towards high-fat foods                | 21.52±5.18         | 20.33±5.63    | 0.06       | <0.00001* |
| High-fat foods intake                          | 43.48±7.62         | 42.57±8.85    | 0.39       | <0.00001* |

α=Result of the student paired-samples t-test (within-groups comparison), β=Result of the independent-samples t-tests (between-groups comparison). SD=Standard deviation, *P<0.05 significant

Table 3: The relationship between high-fat foods intake and knowledge or attitude toward high-fat foods in both groups before and after the intervention

| Variables                                      | Intervention group (r, P) | Control group (r, P) |
|------------------------------------------------|---------------------------|----------------------|
| Before the intervention                        | After the intervention    | Before the intervention |
| Dietary fat nutrition knowledge                | −0.14, 0.32               | 0.05, 0.70            | −0.27, 0.06          |
| Attitude towards high-fat foods                | 0.45, 0.001*              | 0.16, 0.26            | 0.35, 0.01*          |

*P<0.05 significant
Public health providers in Iran should develop further nutrition education interventions to modifying the food culture of people to selecting the healthier choice.

The results also showed that following the intervention, the mean score of the dietary fat nutrition knowledge in the intervention group considerably increased in the participants of the intervention group than the control group. Kamran et al. reported that implementing education program may increase the score of knowledge of rural hypertensive patients in terms of healthy diet in Ardabil, Iran. In addition, this finding is consistent with those of Geaney et al., Pletzke et al., and Abood et al. in other countries. In another study, Park et al. found that nutrition education programs increased nutrition knowledge of female students about the fat content of foods and adequate dietary intake. Literature showed that many consumers did not know whether fats were good or bad, meaning they did not know what to eat and had not basic information about dietary fat. Furthermore, in the present study, there was no significant relationship between knowledge regarding dietary fat nutrition and high fat foods intake in the two groups before and after the intervention. We expected that by increasing the intervention participants’ knowledge, their intake of high-fat foods reduced as well. This finding is inconsistent with the results of such studies. For example, Yahia et al. reported that students with greater nutritional knowledge consumed less unhealthy fats and cholesterol. It was concluded that there was a gap between the knowledge and behavior of the study participants. This finding is in agreement with those mentioned by Packman and Kirk, and Ranga and Venter. For example, Ranga and Venter found that there was no significant association between the students’ fat food knowledge and consumption of foods rich in fat. Similarly, Oli et al. reported that there was a gap between the mothers’ knowledge and diet behaviors. They suggested that deeper understanding of the mothers’ perceived barriers for performing these behaviors could offer important insights to develop effective efforts for reducing the gap between knowledge and behaviors. Given that knowledge alone is not enough to change behavior, attention to other variables such as enabling factors, subjective norms, and so on to increasing the effectiveness nutrition education interventions has been recommended.

In the study, a significant decrease in the positive attitude towards high-fat foods was reported in the intervention group before and after the intervention. In the other words, increasing the positive attitude consumption of high-fat foods increased as well. In line with, Packman and Kirk showed that male college students with a high fat intake had significantly more negative attitudes towards reducing fat consumption than those who had a lower fat intake. Given that attitude towards fat intake might be more important barriers to diet practice change than the level of knowledge of participants, health-care providers should consider this variable, as an important target, in encouraging the participants to reduce high-fat intake and eating less fat.

Conclusion

The results of this study showed that the design of nutrition education intervention could increase participants knowledge in terms of dietary fat nutrition, and reduce positive attitude towards high-fat foods and intake of foods high in fats in women.

In the study, there were some limitations should be attended to. The limitations of this study were including the use of self-report instruments for measuring the frequency of high-fat intake and short duration of follow-up of participants. Performing similar intervention on other population groups such as males is suggested.

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Conflicts of interest

There are no conflicts of interest.

References

1. Lunn J, Theobald HE. The health effects of dietary unsaturated fatty acids. Br Nutr Found Nutr Bull 2006;31:178-224.
2. Riordan F, McGann R, Kingston C, Perry JJ, Schulze MB, Frost Andersen L, et al. A systematic review of methods to assess intake of saturated fat (SF) among healthy European adults and children: A DEDIPAC (Determinants of Diet and Physical Activity) study. BMC Nutr 2018;4:21.
3. White B. Dietary fatty acids. Am Fam Physician 2009;80:345-50.
4. Zock PL. Health problems associated with saturated and trans fatty acids intake. Woodhead Publishing Series in Food Science, Technology and Nutrition. Cambridge, UK: Woodhead Publishing; 2006. p. 3-24.
5. Denke MA. Dietary fats, fatty acids, and their effects on lipoproteins. Curr Atheroscler Rep 2006;8:466-71.
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6. Stender S. Trans fat in foods in Iran, South-Eastern Europe, Caucasus and Central Asia: A market basket investigation. Food Policy 2020;96: 101877.

7. Roefs A, Jansen A. Implicit and explicit attitudes toward high-fat foods in obesity. J Abnorm Psychol 2002;111:517-21.

8. Alizadeh M, Mohtadinia J, Pourghasem-Gargari B, Esmaillzadeh A. Major dietary patterns among female adolescent girls of talaat intelligent guidance school, Tabriz, Iran. Iran Red Crescent Med J 2012;14:436-41.

9. Esmaillzadeh A, Azadbakht L. Food intake patterns may explain the high prevalence of cardiovascular risk factors among Iranian women. J Nutr 2008;138:1469-75.

10. Hyseni L, Bromley H, Kypridemos C, O'Flaherty M, Lloyd-Williams F, Guzman-Castillo M, et al. Systematic review of dietary trans-fat reduction interventions. Bull World Health Organ 2017;95:821-30G.

11. Kamran A, Shirirfard GH, Heydari H, Sharifian E. The effect of theory based nutritional education on fat intake, weight and blood lipids. Electron Physician 2016;8:3333-42.

12. Curtis JP, Adamson JA, Mathers CJ. Effects on nutrient intake of a family-based intervention to promote increased consumption of low-fat starchy foods through education, cooking skills and personalized goal setting the Family Food and Health Project. Br J Nutr 2012;107:1833-44.

13. Sallis FJ, McKenzie LT, Conway LJ, Elder PJ, Prochaska JJ, Brown M, et al. Environmental interventions for eating and physical activity: A randomized controlled trial in middle schools. Am J Prev Med 2003;24:209-17.

14. Risérus U, Willett WC, Hu FB. Dietary fats and prevention of type 2 diabetes. Prog Lipid Res 2009;48:44-51.

15. Kelly BR. Diet and exercise in the management of hyperlipidemia. Am Fam Physician 2010;81:1097-102.

16. Shahrill MR, Wan Dali WP, Lua PL. A 10-week multimodal nutrition education intervention improves dietary intake among university students: Cluster Randomised Controlled Trial. J Nutr Metab 2013;2013:658642.

17. Mumena W, Abdulhakeem F, Jannadi N, Almutairi S, Aloufi S, Bakhshwain A, et al. Nutrition education intervention to limit added sugar intake among university female students. Prog Nutr 2020;22:e200038.

18. Yahia N, Brown CA, Rample M, Chung M. Level of nutrition knowledge and its association with fat consumption among college students. BMC Public Health 2016;16:1047.

19. Ranga L, Venter I. The association between dietary fat knowledge and consumption of foods rich in fat among black first-year students in a south African university self-catering residences. J Consum Sci 2017;2:95-112.

20. Valentin N, Andreea S, Monica T, Zoltan A. Maternal knowledge, attitudes and practices regarding dietary fats. Acta Medica Marisiensis 2016;62:346-9.

21. Eckel RH, Kris-Etherton P, Lichtenstein AH, Wylie-Rosett J, Groom A, Stitziel KE, et al. Americans’ awareness, knowledge, and behaviors regarding fats: 2006-2007. J Am Diet Assoc 2009;109:288-96.

22. Tabatabaei-Malazy O, Qorbani M, Samavat T, Sharifi F, Larjani B, Fakhhrzadeh H. Prevalence of dyslipidemia in Iran: A systematic review and meta-analysis study. Int J Prev Med 2014;5:373-93.

23. Arai K, Mameda E, Iwata T, Tanaka O, Murata K, Sakamoto M. Impact of dietary behaviors on dyslipidemia in Japanese male workers. Ann Transl Med Epidemiol 2014;1:1003.

24. Venter I. Construction of a valid and reliable test to determine knowledge on dietary fat of higher-educated young adults. S Afr J Clin Nutr 2008;21:133-9.

25. Venter I, Winterbach A. Dietary fat knowledge and intake of mid-adolescents attending public school in the Bellville/ Durbanville area of the city of Cape Town. S Afr J Clin Nutr 2010;23:75-83.

26. Lawshe CH. A Quantitative approach to content validity. Pers Psychol 1975;28:563-75.

27. Polit DF, Beck CT. Nursing Research: Principles and Practice. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2004.

28. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1977;33:159-74.

29. Cronbach LJ. Coefficient alpha and the internal structure of tests. Psychometrika 1951;16:297-334.

30. Kroeze W, Oenema A, Campbell M, Brug J. The efficacy of Web-based and print-delivered computer-tailored interventions to reduce fat intake: Results of a randomized, controlled trial. J Nutr Educ Behav 2008;40:226-36.

31. Manios Y, Moschonis G, Katsaroli I, Grammatikaki E, Tanagra S. Changes in diet quality score, macro- and micronutrients intake following a nutrition education intervention in postmenopausal women. J Hum Nutr Diet 2007;20:126-31.

32. Ahmad Z, Pirzadeh A, Hasanzadeh A, Mostafavi F. The effect of a social cognitive theory-based intervention on fast food consumption among students. Iran J Psychiatry Behav Sci 2018;12:e10805.

33. Abood AD, Black RD, Feral D. Nutrition education worksite intervention for university staff: Application of the health belief model. J Nutr Educ Behav 2003;35:260-7.

34. Pletzke V, Henry WB, Ozier DA, Umoren J, The effect of nutrition education on knowledge, attitude, and behavior relating to trans fatty acids in foods. Fam Consum Sci Res J 2010;39:173-83.

35. Kamran A, Shekarchi A, Shiririfad G, Sharifian E, Shekarchi L. Evaluating dietary perceptions education program among rural hypertensive patients on commitment and adherence to healthy diet. J Hum Health 2015:1-7-12.

36. Geaney F, Kelly C, Scotto Di Marrazzo J, Harrington MJ, Fitzgerald PA, Greiner AB, et al. The effect of complex workplace dietary interventions on employees’ dietary intakes, nutrition knowledge and health status: A cluster controlled trial. Prev Med 2016;89:76-83.

37. FrancisM, Nichols SSD, Dalrymple N. The effects of a school-based intervention programme on dietary intakes and physical activity among primary-school children in Trinidad and Tobago. Public Health Nutr 2010;13:738-47.

38. Park SH, Shin JW, Kim SH, Chang KJ. Positive changes in blood lipid profiles, nutrition knowledge, and dietary tauire intake after 8-week nutrition education program in low-income Korean children. Adv Exp Med Biol 2019;1155:273-82.

39. Diekmann C, Malcolm K. Consumer perception and insights on fats and fatty acids: Knowledge on the quality of diet fat. Ann Nutr Metab 2009;54 Suppl 1:25-32.

40. Packman J, Kirk SFL. The relationship between nutritional knowledge, attitudes and dietary fat consumption in male students. J Hum Nutr 2000;13:389-95.17.

41. Olin, Vaidya A, Pahkala K, Eiben G, Krettek A. Knowledge, attitude and practice on diet and physical activity among mothers with young children in the Jhaukel-Duwakot Health Demographic Surveillance Site, Nepal. PLoS One 2018;13:e0200329.

42. Hafteinia E, Alizadeh K, Ghorbani M. Applying the theory of planned behavior to determine factors associated with physical activity by women with hypertension in rural areas of Iran. Asian Biomed (Res Rev News) 2018; 12:83–90.

43. Pirzadeh A, Hazavei MM, Entezari MH, Hasanzadeh A. The effect of educational intervention on girl’s behavior regarding nutrition: Applying the beliefs, attitudes, subjective norms, and enabling factors. J Educ Health Promot 2014;3:79.

44. Engbers-LH, van Poppel MNM, Chin A Paw M, van Mechelen W. The effects of a controlled worksite environmental intervention on determinants of dietary behavior and self-reported fruit, vegetable and fat intake. BMC Public Health 2006;6:253.