Educating people about the healthy edible oils and its storage practices can reduce the incidence of metabolic syndrome: A KAP study

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Abstract

Background: The use of edible oils depends on the traditional practices, educational and socio-economic status. There is a need to educate people regarding the harmful effects of saturated, *trans* fatty acids, proper storage and avoiding repeated usage of edible oils. Surveys, screening programmes and health camps organized by doctors and health professionals are needed to impart the knowledge, which helps in decreasing the incidence of metabolic syndrome and related complications.

Methods: This interventional study was conducted on 10 rural and 15 semi-urban (n=55) families of Puducherry. A set of pre-validated questionnaire in local language was prepared and interview was conducted with the home makers who were involved in handling cooking oils and its storage. KAP scores were calculated and compared with their blood pressure, FPG, serum lipids, HbA_{1c} and insulin resistance. Later, health education was provided to the family members. After 4 months the same procedure was repeated and data were analysed for statistical significance.

Results: The KAP scores, insulin resistance, MDA and serum lipids were significantly improved after four months of intervention ($p<0.05$). But we did not find significant difference among FPG, HbA_{1c} and blood pressure.

Conclusion: Significant improvement was noted in KAP scores, serum lipids, MDA and insulin resistance four months after providing health education for the people residing in rural and semi-urban population of Puducherry.

Key words: Metabolic syndrome, Edible oil, Health education.

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Introduction

There is a rise in the incidence of metabolic syndrome (MetS), type 2 diabetes mellitus (T2DM) and cardiovascular diseases even in rural and semi-urban population of India [1]. This is due to the combined effects of genetic susceptibility, unhealthy eating practices, low socio-economic status, lifestyle changes etc.,[1]. Westernization of dietary habits adds more of saturated and *trans* fatty acids with low quantity of fibers[2]. These factors could lead to MetS and its complications even at the early age[2].

Use of healthy edible oils depends on many factors like, traditional practices, educational and socio-economic status etc., [1, 2]. There is a need to educate people about the usage of healthy edible oils and their safe storage practices. Repeated usage of edible oil leads to conversion of *cis* form of fatty acids to *trans*. Consumption of food stuff with excess *trans* fatty acids is atherogenic[3]. Storage of oils in proper container (air tight, dry and amber colored) is equally important to prevent rancidity[3,4]. In addition, surveys, screening programmes and health camps by doctors and other health professionals could help in imparting the knowledge of beneficial effects of using healthy vegetable oils with more of omega 3, omega 6 polyunsaturated fatty acids [PUFAs] and anti-oxidants [5].

Atherogenic dyslipidemia is an important cardiovascular risk factor. It is commonly seen in people who consume lipids with more cholesterol, saturated and *trans* fatty acids [5, 6]. Use of oils with PUFAs with enriched anti-oxidants like vitamin E, is known to prevent the oxidative rancidity of lipids. Higher degree of oxidative stress causes damages the bio-membranes and biomolecules. Estimation of serum Malondialdehyde (MDA) is commonly used to assess the degree of oxidative stress [6, 7]. There are very few studies comparing serum lipids and MDA with the type of oils they use, effect of educating people about the importance of using healthy cooking oils and their safe storage practices. These types of studies would create the awareness which is lacking among people and would help in reducing the incidence of T2DM, cardiovascular disorders. With this background, this study was planned with the following objectives.

Objectives

- To compare the KAP scores obtained from the Puducherry rural and semi-urban families with their blood pressure, Insulin Resistance, $HBA_{1c,}$ serum lipids and fasting plasma glucose levels.
- To create an awareness regarding the harmful effects of *trans* fatty acids and saturated animal fat.
- To create awareness regarding healthy edible oils, importance of PUFAs and Mono Unsaturated Fatty Acids (MUFAs) in food with proper storage practices of cooking oils.

Methodology

The permission from institute research council and human ethical committee was taken before conducting this study. For this interventional study, we selected 10 rural and 15 semi-urban (n=55) families of Puducherry. The participants who met our inclusion criteria were included in our study after obtaining written informed consent.

Exclusion criteria: The participants who are suffering from T2DM, coronary artery disease or any other vascular or endocrinal diseases were excluded from this study. Patients who denied the consent, who have undergone major gastrointestinal surgeries, suffering from any chronic illness like inflammatory bowel disorders and autoimmune diseases etc., were also excluded.

Five ml of blood was collected by trained technicians under the medical supervision from each participant for studying the parameters. Insulin resistance was calculated by HOMA-IR (homeostatic model of assessment of Insulin resistance) = fasting plasma glucose (mg/dl) X plasma insulin (mg/dl)/405. HbA1c was quantified by automated ion selective chromatography instrument. MDA will be estimated by OxiSelect™ TBARS Assay Kit spectrophotometrically. Serum lipids and fasting plasma glucose were analysed by using International Federation of Clinical Chemistry and Laboratory Medicine approved methods in a fully automated chemistry analyser.

A set of pre-validated questionnaire in local language was prepared and interview was conducted with the housewives/home makers who were involved in handling cooking oil and its storage. The questionnaire involves equal number of questions to assess the knowledge, attitude and practice [KAP] of these subjects regarding the type of oil used, its storage and harmful effects of using some type of cooking oil and improper storage. Based on their response, KAP score was derived which was later compared with the insulin resistance, serum lipids and FPG of them and their family members.

Health education was provided by the principal investigator with a hand out which gave them some tips about the storage practices, list of healthy and unhealthy oils. After three months, the same families were again visited and the same procedure was repeated. Finally, we re-emphasized family members to use healthy cooking oils with more of PUFAs. Instructions were provided (also printed material in local language) for the proper storage of these edible oils. The KAP scores obtained were compared with other parameters.

Statistical analysis: Data were expressed as mean +/- SD; paired student t- test was used to compare the data. A p value <0.05 was considered as significant for all statistical purposes. SPSS version-20 for Windows was used for all statistical analysis. (SPSS Inc., Chicago, USA).

Observation and results

This interventional study was conducted on 25 (10 rural and 15 semi-urban) families of Puducherry population (n=55). We included twenty seven males and twenty eight females with average age of 40.87 years for males and 39.52 years for females. Children, adolescents, women in post-menopausal age group, subjects suffering from T2DM, hypertension or any other morbidity, were excluded from this study. The pre-validated questionnaire was used to obtain the KAP scores.

This questionnaire had equal number of questions to assess the knowledge, attitude and the practices about the edible oil. All the physiological and Biochemical parameters were analysed for significance (Table 1).

Table 1: Physiological and Biochemical parameters before and after the health education

Parameters (n=55)	Before health education	After 4 months of health education	'p' value
FPG (mg/dl)	101.26 ± 25.28	96.89 ± 25.42	0.283
FPI (µU/ ml)	13.59±6.27	08.59±3.42	0.034*****
IR (HOMA- IR)	1.89±8.36	1.07±5.79	0.03*****
HbA_{1c} (%)	5.36±0.41	5.30±0.50	0.339
Serum TC (mg/dl)	199.40±47.40	168.37±31.19	<0.001†
Serum TAGs (mg/dl)	212.66±138.04	194.20±71.75	0.345
Serum VLDL (mg/dl)	42.53±27.61	38.84±14.35	0.345
Serum LDL–C (mg/dl)	113.46±44.44	93.11±27.25	<0.001†
Serum HDL–C (mg/dl)	38.66±5.57	43.20±6.38	<0.001†
KAP scores	16.77±5.35	19.91±5.22	0.002*****
SBP (mmHg)	139 ± 11.13	138 ±13.02	0.325
DBP (mmHg)	82 ± 13.03	81 ±12.02	0.355
Serum MDA (µmols/L)	27.81 ± 2.02	22.06 ± 1.73	<0.021*****

*indicates p <0.05, † indicates p <0.001, Mean values were compared with unpaired student t-test.
SD = Standard Deviation, FPG=Fasting Plasma Glucose, FPI=Fasting Plasma Insulin, IR = Insulin Resistance, HOMA- IR: Homeostatic Model Assessment for Insulin resistance, TC=Serum Total Cholesterol, TAGs=Triacylglycerols, KAP Sores: Knowledge, Attitude & Practice scores, VLDL= Very Low Density Lipoprotein, LDL-C= Low Density Lipoprotein Cholesterol HDL-C= High Density Lipoprotein Cholesterol, SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure, MDA = Malondialdehyde.

Table 2: Association of the KAP scores with the physiological & biochemical parameters after four months of health education

Parameters (n=55)	r value	p value
IR (HOMA- IR)	-0.8	0.021*
Serum LDL–C (mg/dl)	-0.7	0.044*
Serum HDL–C (mg/dl)	+0.6	0.039*
Serum MDA (µ mols/L)	-0.6	0.037*

*indicates p <0.05, Association was seen by using Pearson's correlation analysis. IR = Insulin Resistance, HOMA-IR: Homeostatic Model Assessment for Insulin resistance, KAP Sores: Knowledge, Attitude & Practice scores, LDL-C= Low Density Lipoprotein Cholesterol HDL-C= High Density Lipoprotein Cholesterol, SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure, MDA = Malandialdehyde.

Significant improvement was observed in the KAP scores, serum lipid profile, insulin resistance & MDA levels (Table 1). They have switched over to healthy edible oils (like sunflower, rice bran, corn oils) after the health education was provided. They have minimized usage of food stuff with *trans* and saturated fatty acids. Even the quantity of oil they used was reduced and they used air tight, dry and colored containers too. The correlation was drawn to check the association of the parameters with the KAP score. The improvement in the KAP scores was reflected in their serum lipids, insulin resistance and MDA (Table 2).

Discussion

The incidence of MetS and complications are increasing even in rural and semi-urban population [1, 8]. One of the simple reasons is the lack of knowledge about the healthy edible oils and their proper storage practices. Moreover, majority of people residing rural & semi-urban populations belong to poor socio-economic and educational background. Hence, we planned this study to impart the knowledge about usage of PUFAs and MUFAs rich edible oils and their proper

storage. Also, we wanted to educate people about the harmful effects of *trans* fatty acids and how to avoid them. *Marklund M et al.,* conducted a similar isocaloric randomized trial, *SYSDIET* (Systems Biology in Controlled Dietary Interventions and Cohort Studies) concluding the role of Nordic diet, and it influences on cardiometabolic risk factors [9].

Health education is a simple and cost-effective way by which we can bring about the necessary change required in them. In the current study also, we have documented the same with high KAP scores during the second visit after four months of intervention (health education). This study, in a short span of time, was also successful in improving their lipid profile. Although we did not notice any significant differences in the levels of FPG, HbA_{1C}, Blood pressure, we found significant improvement in insulin resistance with $p<0.05$.[Table 1].

The families started using oils rich in PUFAs and MUFAs which was also reflected in their KAP scores during the second visit. Proper storage of oils prevents the rancidity of oils as well as formation of *trans* fatty which are associated with insulin resistance, endothelial dysfunction and hypertension [10]. *Lakshmipriya N et al.,* used the Food frequency questionnaire to document the type of cooking oils in 1875 adults in Chennai city recorded that prevalence of metabolic syndrome was higher among sunflower oil users (30.7%) than palmolein (23.2%) and traditional oil (17.1%, $p < 0.001$) users [11]. *Kontogianni MD et al.,* reported that consumption of olive oil with more of MUFAs reduces the incidence of acute coronary syndrome [12].

Using edible oils with more of PUFAs, MUFAs and Vitamin E will help us to reduce the level of oxidative stress [13]. High levels of the oxidative stress could cause damage to the bio molecules leading to ill health. MDA levels are most widely used to assess levels of oxidative stress [14, 15]. Use of fresh vegetable oils rich in PUFAs, MUFAs and anti-oxidants will help in decreasing the incidence of metabolic syndrome, T2DM and cardiovascular diseases [16]. More studies are needed even in urban population related to the usage of oils and their implications.

At the end, simple sharing of information and small changes in our kitchen could help in preventing major health upsets! We suggest oils packages by the manufacturers could add this small but an important bit of information will be very useful and could bring in significant health benefits. Schools should bring in the alertness in growing children and imbibe the healthy eating habits from the very beginning. Health department can provide amber colour air tight containers with instructions on it.

Conclusion

Significant improvement in KAP scores, serum lipids, MDA and insulin resistance were noted after providing health education for the people residing in rural and semi-urban population of South India. Health education is a powerful tool to impart the knowledge of harmful effects of *trans* and saturated fatty acids, importance of PUFAs and MUFAs rich edible oils and their storage practices.

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