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Research Article

**ROLE OF TRANS-FATTY ACID AS RISK FACTOR FOR
INSULIN RESISTANCE AND TYPE-2 Diabetes IN ETHNIC
GROUPS OF QUETTA CITY, BALOCHISTAN PAKISTAN**Fatima Yousaf Ali ^{1*}, Asim Iqbal¹, Kashif Kamran¹¹Department of Zoology, University of Balochistan Quetta Pakistan**Abstract:**

Objectives: Type 2 diabetes; a growing global health problem, has a complex etiology involving many interactions between genetic and environmental factors. Therefore, we examined association between the consumption of trans-fatty acids (TFA diet) and fasting lipid profile in patients suffering with type-2 diabetes.

Materials and Methods: This study was performed at Sahib-Az-Zaman medical hospital and Fayyaz diagnostic laboratory at Quetta city during August 2017 to November 2018. A total 400 participants given their written consent for this comparative clinical trial. A questionnaire was designed to record the detailed history about the consumption of TFA. The fasting glucose and lipid profile was performed by overnight fasting of 12 hours. The participants were divided into Group I (consuming trans-fat free lipid) and group II (consuming trans-fat lipid). The results of the two groups were compared in order to determine the correlation of different parameters.

Results: Significant interaction was recorded among certain parameters of trans-fats consuming subjects like serum cholesterol shows a positive correlation with triglyceride, Glucose, total lipids, HDL and LDL. We have recorded high prevalence of type-2 diabetes in Pashtun ethnicity due to massive intake of fatty food.

Conclusion:

Our results suggest a direct significant association between consumption of TFAs with parameters of lipid profile. Our findings also highlighted the possible drastic effects due to excessive intake of TFAs.

Key words: TFAs, Trans Fatty Acid, T2DM, type-2 diabetes, lipid profile.

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INTRODUCTION:

Fats are composite molecules; made up of fatty acids and glycerol essential for proper growth and energy. Fats are the most energy efficient form of food and also the slowest source of energy. Excess body fat can develop imbalance between the energy intake and physical inactivity and therefore considered as basic risk factor for the development of type-2 diabetes[1][2]. Fats exist with different types such as saturated, monounsaturated, polyunsaturated. Beneficial effects of diets can be obtained from monounsaturated [3][4]and polyunsaturated fats [5]. Fatty acid, in association with low-fat, high-carbohydrate diets has the same effects on glucose control and insulin sensitivity have been reported, but these effects have not been seen internationally [6][7].

There are also manmade fats called Trans fats which are produced by adding hydrogen atoms to polyunsaturated or monounsaturated fatty acids in trans configuration due to which it is called Tran's fatty acid. Of all the fats, trans-fats are unhealthiest and recommended to eliminate from diets whenever possible. The consumption of trans fats and its harmful effects on serum lipoprotein profiles [8][9] and insulin sensitivity [10] have been reported in a short-term studies.

According to nutritional plan recommendation the use of saturated fats should be limited from <10% to 5-6% for those who have recommendation of minimum level of Low Density Cholesterol, and trans-fats to <1% of energy or as low as possible [11][12]. Both in animals and humans the higher levels of total dietary fat, regardless of fat types, produce greater insulin resistance [13].

The average intake of industrially produced trans-fatty acid in United States is 2-3% of total calories consumed [14]. Trans-fats have certain sources among them the major sources are fast foods, deep fried French fries, packed snack foods, bakery products, margarines and crackers. Trans-fats that are consumed in small quantity (0.5% of total energy intake) naturally occurs in ruminants like cows, sheep (red meats and dairy products), where in the ruminant stomach these trans fats are produced by the action of bacteria [15].

Therefore, the selection of the topic was made to estimate total lipids ratio and glucose level of trans and non-trans fats consumers among type-2 diabetes based on genders. Additionally, we can hypothesize that the high intake of TFAs may have stronger effects on the onset of type-2 diabetes and insulin

sensitivity.

METHODOLOGY:

The ethical statement and approval of this work was granted by the ethical committee present at the Department of Zoology, University of Baluchistan Quetta. This prospective and comparative clinical study was conducted in Sahib-Az-Zaman medical hospital and Fayyaz diagnostic laboratory from August 2017 to November 2018. The inclusion criteria were the diagnosed cases of type-2 diabetes of any age and gender. The exclusion criteria were the subjects with normal lipid profile and have no history of type-2diabetes.

A total 400 participants were selected belonging to ethnic groups namely Baluch, Hazara, Pashto and Urdu speaking. Participants were further categorized into two groups: group-I comprising of 200 patients (85 males and 115 females consuming trans-fat free lipid) and group-II comprising of 200 patients (90 males and 110 females consuming trans-fats containing lipid). Both groups were analyzed by comparing the fasting lipid profile and gender.

All the selected patients were subject to detail history regarding their dietary habits and collection of fasting venous blood sample to calculate the lipid profile. The main study information was the history of diet especially the variety of oil/solid fat used daily in the preparation of food (Either trans or cis fatty acid). Age and gender was also given priority in this study. The lipid profile was assessed by collecting 3ml of venous blood after 12 hours fasting. The blood samples were centrifuged (80-1, China) at 4000rpm for 5 minutes. After centrifugation the sample was run along with reagent in clinical analyzer (SA-20 CLINDIAG, Japan) by following the manual procedure. The values obtained thus recorded according to the standard values [16]. All the results were recorded according to the template already designed by World Health Organization with little modification [17]. The parameters of study were age, gender, oil and solid fat usage, serum cholesterol, triglyceride, HDL, LDL, fasting glucose level and total lipid. The results data were divided into two groups.

Statistical Analysis:

SPSS (IBM, version: 21) was used to calculate mean of selected parameters along with standard deviations. One tailed Chi-square test was applied by using SPSS to find out the cross comparative correlation between the parameters of trans-fat consumers and trans-fat free consumers with relation to type 2 diabetes. The value $p \leq 0.05$ was considered

to be significant. Microsoft Excel (2007) was used for drawing bar and pie graphs and Z score was calculated [18] among the demographic values via z-score calculator with significant level of 0.05.

RESULTS:

Table-1 shows the demographic values of different ethnic groups including different parameter; age, trans-fat consumers, non-trans-fat consumers, serum cholesterol and triglycerides. Normal and high values were correlated between male and female genders using one-tailed Z-score, where significance of the data was considered at 0.05.

Table-1: Cross comparative studies on demographic values from different ethnic groups of Quetta city, Baluchistan (n=400).

Parameters	Categories	Male	Female	P-values
Age groups	30-70	175(44%)	225(56%)	0.00001
Ethnicity	Baluch	43(25%)	57(25 %)	0.00001
	Hazara	45(26%)	59(26 %)	0.00001
	Pashtun	44(25 %)	60(27%)	0.00001
	Urdu	43(25%)	49(22 %)	0.00001
TFL consumer	Solid fat	90(51%)	110(49%)	0.00001
Non-TFL consumer	Oil	85(49%)	115(51%)	0.00001
Serum Cholesterol				
200-290 mg/dl	Normal	96(55%)	108(48%)	0.00001
140-200	High	79(45%)	117(52%)	0.00001
Triglyceride				
100-149mg/dl	Normal	53 (30%)	69 (31%)	0.00001
150-500	High	122 (70%)	156 (69%)	0.00001
HDL				
55-70mg/dl	Normal	53 (30%)	101 (45%)	0.00001
30-50	High	122 (70%)	124 (55%)	0.00001
LDL				
110-129mg/dl	Normal	80 (46%)	115 (51%)	0.00001
130-160	High	95 (54%)	110 (49%)	0.00001
Glucose				
75-110mg/dl	Normal	75 (43%)	91 (40%)	0.00001
111-350	High	100 (57%)	134 (60%)	0.00001
Total Lipids				
400-566 mg/dl	Normal	75 (43%)	71 (32%)	0.00001
567-2000	High	100 (57%)**	154 (68%)	0.00001

* Z-score was applied and variable significant levels were determined for the male and female parameters comparison at 0.05 alpha values.

** In parenthesis the percentage values achieved by dividing the obtained value divided by total value and multiplied by 100 and rounding off the data.

The comparison of age, lipid profile and glucose level is summarized in Table-2. The mean of serum cholesterol, triglyceride, LDL, Glucose and total lipid of group II was higher than that of group I.

Table-2: Clinical result of groups suffering with type-2 diabetes patients.

Variables	Group I			Group II		
	Max	Min	Mean \pm SD	Max	Min	Mean \pm SD
Age (Years)	75.00	30.00	47.49 \pm 9.33	72.00	28.00	45.84 \pm 8.55
Cholesterol (mg/dl)	310.00	100.00	209.21 \pm 43.97	564.00	125.00	224.76 \pm 60.53
Triglyceride (mg/dl)	1058.00	100.00	301.23 \pm 174.04	1400.00	115.00	336.69 \pm 240.53
HDL (mg/dl)	47.00	32.00	39.96 \pm 3.23	55.00	32.00	39.58 \pm 4.20
LDL (mg/dl)	240.00	39.00	140.90 \pm 44.53	270.00	39.00	146.69 \pm 45.84
Glucose (mg/dl)	398.00	85.00	176.23 \pm 65.28	220.00	130.00	185.84 \pm 133.34
Total Lipids (mg/dl)	1592.00	476.00	844.20 \pm 210.28	1627.00	461.00	888.68 \pm 230.83

Table-2 shows a precise comparison of frequencies of both groups according to which group II indicates a considerable difference from serum cholesterol and triglyceride with mean of 224.76mg/dl and 336.69mg/dl whereas glucose level and total lipids also follow the same pattern with mean value of 185.84mg/dl and 888.68 mg/dl respectively.

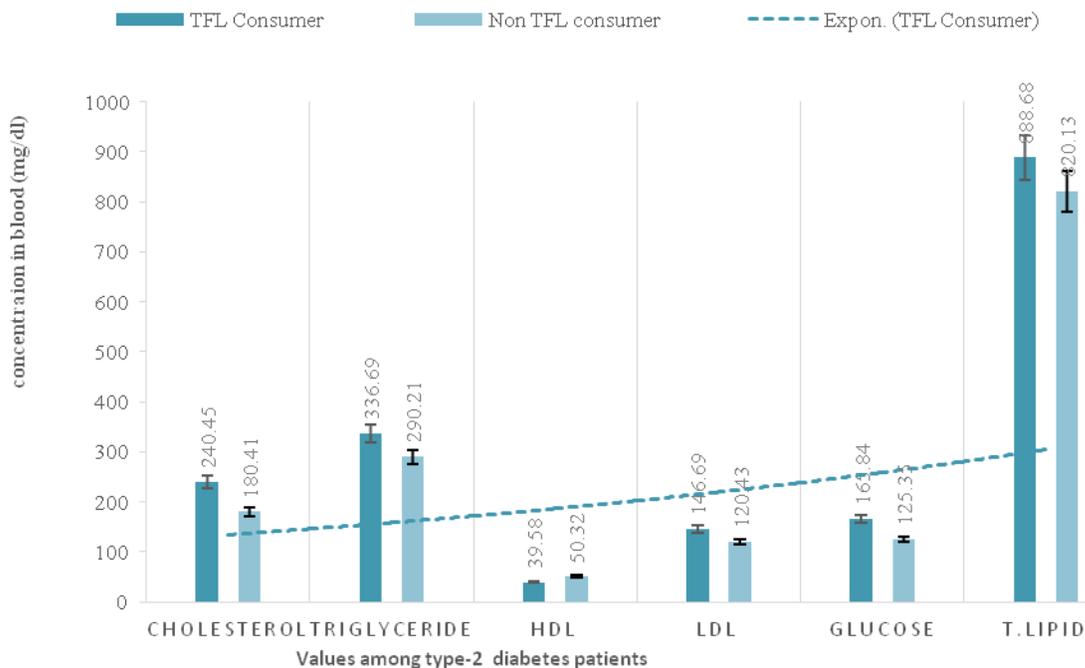
**Figure 1. Comparison of serum lipid profile and Glucose between Group-I and Group II**

Figure 1 compares the values of lipid profile between group I and Group II and according to the mentioned values group II shows a significant increase in the values of serum cholesterol, triglyceride, HDL, LDL, glucose level and total lipid respectively.

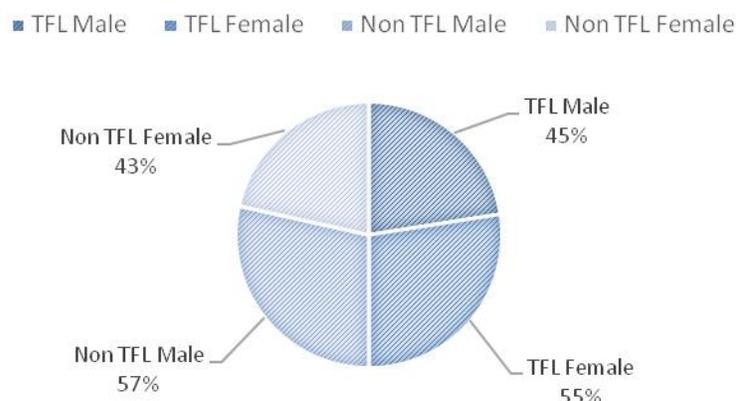
Table-3 Prevalence frequency of type-2 diabetes based on gender in different ethnic groups of Quetta city Balochistan(n=400).

Ethnicity	Male	Female	p-value*
Baluch	24 (56%)	28 (53%)	0.00001
Hazara	25 (56%)	35 (59%)	0.00001
Pashtu	28 (62%)	33 (55%)	0.098**
Urdu speaking	24 (56%) ***	20 (41%)	0.00001

* The results were evaluated on alpha value $p > 0.05$.

** Non-significant values.

*** In parenthesis the percentage prevalence of type-2 diabetic patients both male and female from group I and group II whose glucose level exceed the normal glucose value (75-110mg/dl) are taken and divided by total number of males and female subjects from both groups and multiplied by 100 and round off the resulting values.

Figure-2: Prevalence frequency of type 2 diabetes based on gender.

Based on ethnicity the prevalence of type-2 diabetes among females remains highest 59% and 55% in Hazara and Pashtun ethnic groups. Whereas, in Baluch and Urdu speaking participants remained with 28% and 20% respectively. Furthermore, in male population the highest prevalence of the disease remain in Pashtun with 62% followed by 56% in Baloch, Hazara and Urdu speaking respectively.

DISCUSSION:

This study indicates that both women and men are at high risk for the disease that can be prevented from the onset of this issue by changes in lifestyle and eating patterns. In our study all the participants selected for the study was the diagnosed cases of type-2 diabetes. We studied 200 subjects which had a history of consumption of trans fats lipid. Trans-fats intake has been associated with the higher risk of developing type-2 diabetes. The relation is explained by the adverse effects of trans-fatty acids on lipid

profile as trans-fats raise the level of serum cholesterol, triglyceride, glucose and total lipids. Due to disturbances in lipid profile the incidence of type-2 diabetes may occur. About, 5-10% fats in American diet and 5% in American adipose tissues is trans-unsaturated fatty acid [19] and this intake can lead towards cardiovascular diseases (CVD).

Concerns have been made for several decades about the consumption of trans-fatty acid that has contributed to the 20th century epidemic of type-2 diabetes [20][21]. World bank has classified all of the country in this region as low or middle-income in the year 2015 by experiencing 3.5% annual economic growth during this year [22][23]. Globally magnificent increase in the frequency of diabetes has been reported, however the incidence of type-2 is growing more rapidly [24]. It is forecasted that the threatening increase in the occurrence of diabetes is due to heavy industrialization along with its relation to inactive lifestyle which causes obesity;

malnutrition of fetus and mother as well as certain other environmental and genetic factors are responsible for this massive increase in the prevalence of diabetes [25][26].

Abrupt use of traditional Pakistani food that is rich with trans fatty acid because of its taste is another contributory factor towards the onset of this disease, because of all these factors the incidents of diabetes increasing while the management of this disease is out of control along with its risk factors[27][28]. Our result also highlighted especially in Pashtun ethnicity having high rate of diabetes (62%) due to excessive intake of fatty foods. Trans-fat act like saturated fat by raising the level of LDL, serum cholesterol, triglyceride, total lipids and glucose and this increased level of total fat causes the increase in the level of glucose which causes type-2 diabetes [29] but it has an additional effect as it decrease the level of HDL in the blood which presents harmful effects to the health in terms of CVD.

CONCLUSION:

In conclusion, it is found that the excess intake of trans-fatty acid is the major contributor of type-2 diabetes as it is directly linked by increasing the level of total lipid in the body which causes hindrance in glucose absorption due to which impaired glucose tolerance may occur, secondly it causes disturbance to the ratio of HDL and LDL levels by increasing the level of LDL-cholesterol (bad cholesterol) and decreasing the level of HDL-cholesterol (good cholesterol). Therefore, it is necessary to alleviate the consumption of trans fat from the diet by replacing it with trans-free fats in order to avoid the increasing incidences of diabetes.

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