# TRANS FATTY ACID;

## A confounding risk factor in coronary heart disease

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ABSTRACT: Objectives: To find out the correlation between the consumption of trans fatty acid and fasting lipid profile & body mass index (BMI) in patients suffering from coronary heart disease. Study Design: Prospective, comparative clinical study. Study Site & Duration: This study was conducted at Shafakhana Sahib az Zaman Medical Hospital Quetta from April, 2007 to May, 2008. Material & Methods: This comparative clinical trial was conducted on 50 patients (n=50) to find out the correlation between the consumption of trans fatty acid and fasting lipid profile & body mass index (BMI) in patients suffering from coronary heart disease. Detail history about the use of Trans fats containing products was recorded. Patient's height and weight was recorded by standard calibrated standiometer. The fasting glucose and lipid profile was performed by overnight fasting of 12 hours. The patients was divided into group I (n=18), who used Trans fats free oil/ghee and group II (n=32), who used trans fats containing ghee. The results of the two groups were compared and correlation of different variables was determined. Results: The study result shows that mean age $58.428 \pm 9.67721$ years, mean height $5.476 \pm .5899$ feet, mean weight $61.5 \pm 4.8793$ Kg and mean BMI was $22.35 \pm 5.24195$ Kg/m2. There was slightly higher value of BMI in group II. The comparison of serum lipid profile and glucose among the two groups shows that there is a correlation of Trans fatty acid with certain parameters like high density lipoprotein (HDL) and total lipid with p-value of 0.027 & 0.014 respectively. Similarly serum cholesterol and low density lipoprotein (LDL) correlated with Trans fats lipid having both p- value of 0.000. Conclusions: There is a correlation of Trans fatty acid with serum cholesterol, LDL, HDL and total lipid. The consumption of Trans fatty acid has shown positive correlation of certain parameters with each others like weight shows correlation with serum cholesterol, LDL and total lipid, LDL shows correlation with diastolic blood pressure, triglyceride shows correlation with systolic blood pressure while BMI shows negative correlation with HDL.

Key words: Low density lipoprotein (LDL), High density lipoprotein (HDL), Body mass index (BMI)

## INTRODUCTION

The term 'Trans fats' generally refers to a fat that contains one or more fatty acid group in Trans configuration. Fatty acids containing the maximum possible number of hydrogen ions is said to be saturated; otherwise; it is unsaturated to some degree. Trans fat is unsaturated fat. It may be mono-unsaturated or polyunsaturated. The major dietary sources of trans fatty acids are vegetable oil condensation, solid margarines, crackers, candies, cookies, snack foods, fried foods, baked foods, and other processed foods[1]. It also occur naturally at relatively low levels in meat and dairy products (1 to 8%) as a result of the fermentation process in the animal's rumens[2].

Metabolic studies have shown that trans fats have adverse effects on blood lipid profile. It increases the plasma low density lipoprotein (LDL), while decreasing high density lipoproteins (HDL). This combined effect altered the ratio of LDL to HDL resulting in an increased risk of coronary heart disease[2]. In a study conducted by Mozaffarian D et, al; indicates that 1.2 million annual myocardial infarctions and deaths from coronary heart disease in the United States occurred due to consumption of trans fats lipid, while the elimination of industrially reduced trans fats might avert coronary heart disease events each year from 6% to 19% . For these reasons, health authorities worldwide recommend that consumption of trans fat be reduced to trace amounts (<1% of total daily energy intake). Trans fats from partially hydrogenated oils are generally considered to be more dangerous than naturally occurring trans fats[3].

Dietary trans-fatty acids are associated with increased risk of cardiovascular disease and have been implicated in the incidence of obesity[4]. Trans fat exists

in both either solid or semi solid state has the capability to accumulate in adipose tissues of the body and can cause obesity or weight gain; therefore; It is established that high-fat saturated diets, relative to low-fat diets, induce adiposity and weight gain and hence disturb the normal body mass index (BMI) of an individual[5,6].

This study trial was carried out in order to determine the effects of prolong consumption of trans fatty acid on fasting lipid profile and BMI in patients suffering from coronary heart disease.

## MATERIAL & METHODS

This prospective, comparative clinical study was conducted in Shafakhana Sahib az Zaman Medical Hospital, Quetta from April, 2007 to May, 2008 on 50 patients (n=50). The patients were selected from the medical outpatient department. The objective of the study was to find out the correlation between the consumption of trans fatty acid and fasting lipid profile & body mass index (BMI) in patients suffering from coronary heart disease. The inclusion criteria were the newly diagnosed cases of coronary heart disease of any age and gender, who gave the informed consent. The exclusion criteria were the patients who had prolong history of coronary heart disease and had been treated and adapted the preventive measures.

All the selected patients were subjected to detail history regarding their dietary habits, physical examination like measurement of height and weight to calculate the BMI 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/ghee used daily in the preparation of food (Either trans or cis fatty acid). Weight was measured in the upright position to the nearest 0.1 Kg using a calibrated beam scale. Height was measured without shoes to the nearest 0.1 cm using a calibrated standiometer. Body mass index was calculated by weight in Kg divided by height in meter square. The

lipid profile was assessed by collecting 3 ml of venous blood after 12 hours fasting. These values were recorded according to the standard values.

All the results were recorded on prescribe performa especially designed for it. The parameters of study were, age, gender, height, weight, BMI, socioeconomic group, frequent food used, nutrition, serum cholesterol, LDL, HDL, triglyceride, total lipid and glucose level. The data results were divided into two groups.

Group I: It includes 18 patients, who use the trans fats free oil/ ghee.
Group II: It includes 32 patients, who use the trans fatty acid ghee.

The results of the two groups were analysed by comparing the fasting lipid profile and BMI. Chi square test was applied to find the value of significance. The value < 0.05 was considered to be significant. Finally the correlation of trans fat was done with coronary heart disease.

## RESULTS

This prospective, comparative clinical study trial was conducted on 50 patients (n=50) which revealed that there were 18 females and 32 were males. The patients were divided into group I (n= 18) who used trans fats free oil/ ghee, while group II (n= 32) who used trans fats containing ghee. The comparison of age, height, weight and BMI was made between the two groups (Table-I). The mean age, height and weight of group I was slightly higher than that of group11, while the BMI was slightly higher in group II.

The mean of serum cholesterol of those patients consuming TFL ghee is 230.06±7.987, with minimum serum cholesterol level is 105 mg/dl and maximum level is 290 mg/dl. The mean of HDL is 49±6.345, where as minimum HDL in blood is 105mg/dl and maximum level is 290mg/dl. The mean

of LDL is 230.06± 5.765, whereas minimum level of LDL is 105 mg/dl while maximum level is 290 mg/dl. The mean of triglyceride is 48.943± where minimum level of triglyceride in blood is 41 mg/dl while maximum level is 65 mg/dl.

The comparison of serum lipid profile and glucose among the two groups were made. It was found that there is a correlation of Trans fats with certain parameters like high density lipoprotein (HDL) and total lipid with p-value of 0.027 & 0.014 respectively (Normal significant value of 0.05). Similarly serum cholesterol and low density lipoprotein (LDL) correlated with trans fats lipid having both p- value of 0.000 (Normal significant value of 0.01). There is a correlation among parameters of group I & II cholesterol and LDL (with significant value of 0.01), where as total lipid and HDL (with significant value of 0.05).

| | GROUP I | | | GROUP II | | |
|---|---|---|---|---|---|---|
| | **Mean** | **Minimum** | **Maximum** | **Mean** | **Minimum** | **Maximum** |
| **Age** (Years) | 58.11 | 45 | 80 | 55.906 | 40 | 82 |
| **Height** (Feet) | 5.605882 | 4.2 | 6.4 | 5.409 | 4.5 | 6.4 |
| **Weight** (Kg) | 61.212 | 55 | 70 | 62.235 | 65 | 75 |
| **BMI** (M2/Kg) | 22.058 | 16 | 30 | 23 | 22 | 34 |
| **Table-I. Comparison between two groups** | | | | | | |



Fig-1. Comparison of serum lipid profile & glucose among two groups
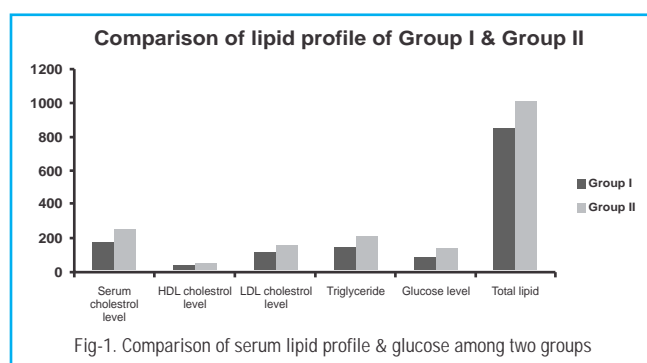
A positive correlation was found among parameters of trans fats consuming subjects where weight was positively correlated with LDL cholesterol, serum cholesterol and total lipids with significant value of (0.01, 0.05, 0.05) respectively. Similarly BMI was positively correlated with HDL cholesterol with significant value of (0.05),while serum cholesterol shows positive correlation with diastolic BP, LDL cholesterol and glucose level with significant value of (0.01, 0.05, 0.05) respectively. Whilst HDL cholesterol remain positively correlated with BMI (0.05) while LDL cholesterol shows positive correlation with diastolic BP, serum cholesterol and glucose level with significant value of (0.05, 0.05, 0.01) respectively. Similarly triglyceride shows positive correlation with systolic BP and total lipid with significant value of (0.01) and glucose remain positively correlated with diastolic BP, LDL cholesterol and serum cholesterol with significant value of (0.05, 0.01, 0.05) respectively and total lipid remain positively correlated with triglyceride only with significant value of (0.01).

A positive correlation was found among several parameters of trans fats free subjects in which weight was found positively correlated with systolic BP, diastolic BP, serum cholesterol, triglyceride and total lipid with significant value of (0.01, 0.05, 0.05, 0.05, 0.05) respectively where as serum cholesterol shows positive correlation with triglyceride, glucose and total lipid with significant value of (0.01, 0.05, 0.01) respectively, however HDL cholesterol remain positively correlated with diastolic BP with significant value of (0.05) while triglyceride shows positive correlation with diastolic BP, serum cholesterol and

total lipid with significant value of (0.05, 0.01, 0.01) respectively whilst a positive correlation was found among glucose and serum cholesterol with significant value of (0.05). Total lipid shows positive correlation with serum cholesterol and t riglyceride with significant value of (0.01, 0.01) respectively.

## DISCUSSION

Trans fats are unsaturated fatty acids with at least one double bond in the trans configuration are formed during the partial hydrogenation of vegetable oils, a process that converts vegetable oils into semisolid fats for use in margarines, commercial cooking, and

|  | BMI | Systolic BP | Diastolic BP | HDL | LDL | Serum cholesterol | Triglyceride | Glucose level | Total lipid |
|---|---|---|---|---|---|---|---|---|---|
| Weight | _ | _ | _ | _ | 0.01 | 0.05 |  |  | 0.05 |
| BMI | _ | _ | _ | 0.05 |  |  |  |  |  |
| Serum cholesterol | _ | _ | 0.01 | _ | 0.05 |  |  | 0.05 |  |
| HDL | 0.05 | _ | _ | _ |  |  |  |  |  |
| LDL | _ | _ | 0.05 | _ |  | 0.05 |  | 0.01 |  |
| Triglyceride | _ | 0.01 |  | _ |  |  |  |  | 0.01 |
| Glucose Level | _ | _ | 0.05 | _ | 0.01 | 0.05 |  |  |  |
| Total-lipid | _ | _ |  | _ |  |  | 0.01 |  |  |

**Table-II. Cross Tabulation Between parameters of trans fats consuming subjects**

|  | BMI | Systolic BP | Diastolic BP | Serum Cholesterol | HDL | LDL | Triglyceride | Glucose | Total lipid |
|---|---|---|---|---|---|---|---|---|---|
| Weight | _ | 0.01 | 0.05 | 0.05 | _ | _ | 0.05 | _ | 0.05 |
| BMI | _ | _ | _ | _ | _ | _ | _ | _ |  |
| Serum cholesterol | _ | _ | _ | _ | _ | _ | 0.01 | 0.05 | 0.01 |
| HDL | _ | _ | 0.05 | _ | _ | _ | _ | _ |  |
| LDL | _ | _ |  | _ | _ | _ | _ | _ |  |
| Triglyceride | _ | _ | 0.05 | 0.01 | _ | _ | _ | _ | 0.01 |
| Glucose Level | _ | _ |  | 0.05 | _ | _ | _ | _ |  |
| Total-lipid | _ | _ | _ | 0.01 | _ | _ | 0.01 | _ |  |

**Table-III. Cross Tabulation between parameters of trans fats free subjects**

manufacturing processes. From the perspective of the food industry, partially hydrogenated vegetable oils are attractive because of their long shelf life, their stability during deep-frying, and their semi-solidity, which can be customized to enhance the palatability of baked goods and sweets. The average consumption of industrially produced trans fatty acids in the United States is 2 to 3 percent of total calories consumed[7]. Major sources of trans fats are deep-fried French fries, fast foods, bakery products, packed snack foods, margarines and crackers. Naturally occurring trans fats are consumed in smaller amounts (about 0.5 percent of total energy intake) in meats and dairy products from cows, sheep, and other ruminants;

these trans fats are produced by the action of bacteria in the ruminant stomach[8]. In our study 32 patients had a history of consumption of trans fats containing ghee.

Trans fats intake has been associated with a higher risk of coronary heart disease. The relation is explained only partially by the adverse effect of these fatty acids on the lipid profile[9]. Approximately 5 to 10 percent of the fat in American diet and about 5 percent of the fat stored in American adipose tissue is trans unsaturated fat. Concerns have been raised for several decades that consumption of Trans fatty acids might have contributed to the 20th century epidemic of coronary heart disease[10,11]. In our study all the participants selected for study was the diagnosed cases of coronary heart disease.

The primary health risk identified for trans fat consumption is an elevated risk of coronary heart disease (CHD)[11]. A comprehensive review of studies of trans fats was published in 2006 in the New England Journal of Medicine that concludes that there is a strong and reliable connection between trans fat consumption and coronary heart disease. The major evidence for the effect of trans fat on coronary heart disease comes from the Nurses' Health Study (NHS) — a cohort study that has been following 120,000 female nurses since its inception in 1976. In this study, Hu and colleagues analyzed data from 900 coronary events from the NHS population during 14 years of follow up. He determined that a nurse's coronary heart disease risk roughly doubled for each 2% increase in trans fat calories consumed (instead of carbohydrate calories)[8]. By contrast, it takes more than a 15% increase in saturated fat calories (instead of carbohydrate calories) to produce a similar increase in risk. Eating non-trans unsaturated fats instead of carbohydrates reduces the risk of coronary heart disease rather than increasing it. Hu also reports on the benefits of reducing trans fat consumption. Replacing 2% of food energy from trans fat with non-trans unsaturated fats more than halves the risk of CHD

(53%). By comparison, replacing a larger 5% of food energy from saturated fat with non-trans unsaturated fats reduces the risk of CHD by 43%[9]. Another study considered deaths due to coronary heart disease, with consumption of trans fats being linked to an increase in mortality, and consumption of polyunsaturated fats being linked to a decrease in mortality[12,13].

In our study it was revealed that there is a correlation of Trans fatty acid with certain parameters like high density lipoprotein (HDL) and total lipid with p-value of 0.027 & 0.014 respectively (Normal significant value of 0.05). Similarly serum cholesterol and low density lipoprotein (LDL) correlated with trans fats lipid having both p- value of 0.000 (Normal significant value of 0.01). Trans fat behaves like saturated fat by raising the level of LDL, but unlike saturated fat it has the additional effect of decreasing levels of HDL. The net increase in LDL/HDL ratio with Trans fat is approximately double that due to saturated fat. The exact biochemical methods by which Trans fats produce specific health problems are a topic of continuing research[2,14].

## CONCLUSIONS
In conclusion, it is found that the consumption of trans fatty acid is the major contributor of coronary heart diseases because it is responsible in disturbing the ratio of HDL-cholesterol and LDL-cholesterol by increasing the level of LDL-cholesterol(bad cholesterol) and decreasing the level of HDL-cholesterol(good cholesterol) hence causing atherosclerosis in arteries. There is a correlation of Trans fatty acid with serum cholesterol, LDL, HDL and total lipid. The consumption of Trans fatty acid has a positive correlation of weight with serum cholesterol, LDL and total lipid, LDL with diastolic blood pressure and triglyceride with systolic blood pressure. There was negative correlation of BMI with HDL. Hence trans fat lipid is a major component of confectionary and tin packed food therefore it can be replace with trans fat free lipid in order to avoid the increasing incidences of

coronary heart disease.

## ACKNOWLEDGMENT

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