








Original article

Impacts of Breakfast Eating Behaviors on Lipid Profile of University going Students

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Abstract

Change in dietary patterns influenced the health status of people worldwide. The devastating burden of metabolic diseases is now the major challenge for developing economies. Mostly people skip their breakfast and used to consume higher quantities of fried foods during their craving conditions. These fried foods are leading cause of various disorders in body including hyperlipidemia and cardiovascular diseases. Current study was conducted to evaluate lipid profile and physical parameters of the graduate students (Healthy breakfast eaters, fried foods breakfast eaters and breakfast skippers). For this purpose, data collected through the questionnaire was utilized to estimate and evaluate some parameters (i.e., BMI, total proteins, total carbohydrates and total fats) about dietary habits of participants. The chemistry analyzer was utilized to determine the lipid profiling (i.e., Total cholesterol, Triglycerides, HDL, LDL, and VLDL) of selected candidates. The results depicted that the total cholesterol and triglyceride levels were observed higher in no breakfast eaters as compared to breakfast eaters and healthy breakfast eaters. Moreover, TCs (206.13±24.52mg/dl) and TGs (241.40±115.17mg/dl) were extraordinary higher in females and males of NBE groups, accordingly. HDL levels were lower and LDL levels were higher in non-breakfast eaters. BMI and Total fat were also higher in non-breakfast eaters indicating the increased health risks. Thus, to prevent chronic metabolic disorders the healthy eating pattern should be promoted.

Keywords: Lipid profiling, Cholesterol, Triglycerides, BMI, Breakfast habits.

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INTRODUCTION

This era of lifestyle shift has changed the people's psychological, nutritional, emotional and relational life. This brought the young generation towards dietary imbalance by altering their eating habits (Werf et al., 2021). The use of modern-day technology is the major contributor that influenced the sleeping pattern of remote workers and youngsters thus promoting breakfast absenteeism (Zaki et al., 2020). The skipping of breakfast cereals and use of snacks is directly correlated with multiple metabolic and degenerative disorders such as colorectal cancer, inflammatory bowel disease (IBD), obesity, hyperlipidemia and coronary heart disease (Moszak et al., 2020). The concept of snacking loaded with saturated fatty acids and refined sugars along with additives and preservatives has created chronic health problems (Srouf et al., 2019). The foods with low nutritional value are categorized as junk foods. The increased consumption of junk foods and snacks with no nutritional value are considered unhealthy when taken regularly (Cutumisu et al., 2017). The unsatisfactory contents of proteins, minerals, vitamins and fiber affected the growing population of the world leaving physiological impacts and altering the brain activity similar to addictive drugs like cocaine or heroin (Wiss, 2019).

Regardless the age factors, junk foods effect health status of individuals directly when consumer eat too much. The chances of being ill by addicting to junk foods got worsen and people are more vulnerable to hypertension, cardiovascular diseases and diabetes (Alsabieh et al., 2019), high blood pressure, cancer, liver damage, gall bladder disease (Kazi et al., 2020), vomiting, depression, tooth decay, obesity and other chronic diseases (Ashakiran and Deepthi, 2012). The junk foods create an empty stomach thus promoting more cravings and desire to eat more, this actually create an energy imbalance (Fuhrman, 2018). Most important part of the junk foods is dietary lipids which are present in the form of cholesterol, triglycerides, phospholipids, sphingolipids and fatty acids. These are essential for integrity to the cell membrane, provide cohesiveness and vital to the human body. Lipids regulate fat soluble vitamins, bile acids, steroid hormones and being the component of cell membrane (Papotti et al., 2021; Obniski, Sieber, and Spradling, 2018).

Lipids represented by phospholipids, cholesterol, triglycerides (TG) and fatty acids, are considered essential to the human body as these play a key role in development of basic structure of cell membranes (phospholipids), act as precursor to steroid hormones, bile acids and vitamin D, and also provide sites for enzyme actions (Salih, 2021). These organic molecules give rigidity and fluidity to the cell membrane. Normal Blood lipid profile has total cholesterol <200mg/dl, HDL \geq 40mg/dl, LDL <130mg/dl and triglycerides <150mg/dl (Zhang et al., 2021). The junk foods are rich in fatty portion, which is the reason for elevated level of cholesterol, decreased HDL, and increased LDL thus creating an abnormal lipid profile known as dyslipidemia (Lechner et al., 2020). These situations are alarming for all community members and disturbance diet proportionality affecting the body for long run. The arteriosclerosis is the major reason of fatigue and adversely affects the heart health. The excess amount

of cholesterol in human body can destroy the liver, leaving the effected person overweight at the same time. The poor health status is not the clear indication of abnormalities but can lead to several heart related problems (Dettlaff and Boyd, 2020). Different studies indicated that the consumption of breakfast cereals have the potential to reduce chronic illness of the gastrointestinal system. In the today era the concept of food of specific health use can be developed to reduce the chronic malnutrition (Gong et al., 2018).

The aim of present research was to identify the lipid profile through blood samples of graduate students to promote their health. Furthermore, study was planned to evaluate the effects of fried food on lipid profile and the dietary intake of university students from both genders i.e., females and males having different breakfast eating habits.

METHODOLOGY

Sample Selection

The current study was conduct on humans of Bahauddin Zakariya University (BZU). The 90 healthy students with the age ranging from 20 to 25 were selected. These students selected for the study were from both genders on equal basis i.e., 45 males and 45 females and were divided into 3 groups equally.

The young females with good health, menstruation in regular intervals were selected for study. It was also ensured that the female subjects were not pregnant, lactating to any child and had no previous history of various diseases i.e., hypercholesterolemia, dyslipidemia, hyperglycemia, and any other critical issue. Males with good health status were selected, and were neither smoker nor alcohol consumers. Moreover, it was also remained under considerations that they had not suffered from hypercholesterolemia, dyslipidemia, and hyperglycemia, or any other critical issue.

Three groups were designed in such a way that each group contained equal subject from both genders. 1stgroup of breakfast consumers was divided into 2 sub-categories i.e., fried foods breakfast consumers (FBE; consume fried foods in breakfast) and healthy breakfast eaters (HBE; do not consume fried products in breakfast). 2ndgroup of was of non-breakfast consumers (NBE; do not consume anything in breakfast) but consume fried products in university.

Anthropometric Measurements

Anthropometric measurements including height, weight and BMI of all participants were taken. Weight was measured by weighing balance when subjects were in light clothing, bear feet and empty pockets. Height was measured by using stadiometer (Standard Steel: Hm01) to nearest 0.1cm. BMI of all subjects was calculated by using BMI calculating formula (Lemmens, Brodsky, and Bernstein, 2005).

$$\text{BMI} = \frac{\text{Weight (Kg)}}{\text{Height (m}^2\text{)}}$$

Dietary Assessment

Dietary assessment was conducted by collecting information through filling out the questionnaire about the food eaten in last 24 hours. For this purpose, the subjects were advised to provide all necessary details about their eating pattern and types of foods and meals consumed in last 24 hrs.

The questionnaire with three different sections was prepared for all groups according to required information for this research. The complete history of eating habits and food types of previous week was taken from respondents through questionnaires. The questions included in questionnaire were regarding their previous medical records, in which consideration of various diseases interlinked with lipids were in priority of this study hypercholesterolemia, dyslipidemia, hyperglycemia, or other related critical issue previous years. Initially, list of consuming foods was noted from respondents and all information regarding the types of foods and drinks and eating habits i.e., time intervals was collected. Moreover, the portion size of each meal in different parameters/units e.g., gram, cups and bowl was recorded with the ease of respondent and converted into grams and to calculate the calorie intake from consumed diet of previous 24 hours. The Pakistan Food Composition data based utilized for this calculation (anonymous, 2001).

Collection of Samples

The participants were advised to avoid eating anything for last 12hrs before sampling and also advised to avoid any kind of exercise except activities of daily routine. Then blood samples were taken from all groups early in the morning and placed in VACUETTE® LH lithium heparin tubes (Green top tube; M/s. Becton, Dickinson and Company) and stay time of 10min was given for blood clotting. These samples were then centrifuged in at 5000rpm in centrifugation machine for 5 minutes to separate the RBCs and serum. Then, serum was isolated in Eppendorf tube and placed at 2°C in freezer for determination of lipid profile in letter stages.

Lipid Profile Analysis

Various tests for lipid profiling includes determination of triglycerides (TG), high density lipoprotein cholesterol (HDL), total cholesterol (TC), low density lipoprotein cholesterol (LDL), and VLDL were conducted through chemistry analyzer (with specifications; Evolution 3000) using commercial kits and following specific method for each test i.e., HDL-cholesterol was analyzed by using HDL-cholesterol Precipitation method provided by Assman et al. (1996), Total serum cholesterol was analyzed by CHOD-PAP method describes by Stockbridge *et al.*, (1989), and Triglyceride concentrations were determined by using GPO-PAP method. Moreover, LDL and VLDL were calculated through generalized formula of Friedl Wald (1972).

Statistical Analysis

The collected information was compiled and arranged on excel sheet and Statistix 8.1 was used to analyze the collected data statistically. The factorial design 2-way ANOVA was applied to check out the significance level of data and validity of this research.

RESULTS and DISCUSSION

Lipid Profiling

Cholesterol is waxy in nature and vital part of cell membrane generated by animal liver. The major sources of dietary cholesterol are fish, poultry, meat and dairy based products (Madu, and Yakubu, 2018). It performs various functions in human body i.e., formation cell membrane, isolation and sensation of nerves, develop various hormones, major element of few membranes of body and also improve the heart health. Cholesterol is divided into two groups such as cholesterols with high density lipoprotein (HDL) or with low density lipoprotein (LDL) (Sekimoto et al., 2021). The significant ($p \leq 0.05$) differences of total cholesterol (TC) levels were obtained in all groups and highest cholesterol levels were observed in NBE ($206.13 \pm 24.52 \text{mg/dl}$). The results showed higher concentrations of cholesterol in females of all groups in comparison to males of respective groups. The assessment of dietary habits of previous 24-hours helps to estimate that NBE group consumes more fried foods than HBE and HBE groups. The same pattern was observed by García-Calzón et al. (2018), who suggested that the women contains higher amount of total cholesterols because the low working activities and higher deposition rate in skeletal muscles of body.

Triglyceride (TG) is the combination of three fatty acids combined attached to single glycerol molecule (Potcoava et al., 2021). These are major part of blood stream as well as body fats and concentrations of TGs vary with respect to gender, height, weight and age in humans. The higher amounts of TGs attached to the HDL or LDL cholesterols are responsible for atherosclerosis enhancement, which ultimately increase the fat deposition in artery walls resulting in higher risks of cardiovascular diseases (Kontush, 2020). It was noticed that the people suffering from diabetes and heart related disorders have higher amounts of TGs (Zhao et al., 2020). Current research results indicated that the variations in TG levels of different groups and genders were significant. The highest TG levels were obtained in male group of NBE ($241.40 \pm 115.17 \text{mg/dl}$) and lowest triglycerides levels ($86.33 \pm 32.18 \text{mg/dl}$) were observed in females of HBE. The least triglycerides level in fried food breakfast eater was might be due to the small portion size of breakfast food of females. A study reported the similar effects of non-breakfast and breakfast entering habits of participants on obesity and other linked cardiovascular diseases (McIver, 2020).

Cholesterols are categories in LDL and HDL based on their functionality. HDL contains higher concentrations of proteins and lower amounts of cholesterols, therefore consider healthier for

cardiovascular system (Ben-Aicha, Badimon, and Vilahur, 2020). Furthermore, it helps in extract of excessive cholesterol from the blood vessels and old cholesterol from body for its delivery to the liver. Later on, this excessive cholesterol is transferred to the GIT tract for elimination or recycling (Ouimet, Barrett, and Fisher, 2019). However, it performs anti-inflammatory functions, lessens the chances of injuries of blood vessels and aids the body to retain the blood vessels in expended form by influencing the blood flow (Miao et al., 2020). The significant differences were observed between the HDL value of different genders and non-significant variations were observed in HDL concentrations among under study groups. The highest levels of HDL were observed in females of all groups as compared to the HDL level in males of all groups. The low HDL levels along with hypertriglyceridemia and obesity were observed in females. However, hypertriglyceridemia, increased BP and little bit higher HDL levels are observed in males (Mendoza-Caamal et al., 2020).

Low density lipoproteins contain higher amounts of cholesterol and lower concentrations of proteins and consider unhealthier for health heart health. It is considered as a major source of blockage of arteries and plays an important role in transferring of healthier cholesterol from liver to the body tissues and muscles. The absorption of this cholesterol is take place in membrane of various body cells (Hongbao, Ma and Yan). The results indicated the considerable difference among groups and genders. The higher amounts of LDL were observed NBE followed by FBE and HBE groups of males. Likewise, same patterns were obtained among females of these groups. The LDL concentration was in contradiction to the study of Witbracht et al. (2015) which resulted the lower LDL in breakfast eaters.

Very Low density lipoprotein cholesterol is a type of LDL commonly known as bad cholesterol. It contains little amounts of protein and higher amounts of cholesterol, which is bad for cardiovascular health. The higher amounts of VLDL and LDL are connected with greater risks of cardiovascular disorders (Chait et al., 2020). The higher amounts of VLDL were observed in NBE of male population in comparison to both breakfast eating groups. The VLDL concentrations were observed similar in all female groups, whereas, significantly different between genders with in groups. The higher VLDL values were observed in males as compared to females of respective groups. However, the highest VLDL value was (47.93±23.15mg/dl) observed in Non-breakfast eater male group. The study revealed insignificant differences among males and females of HBE group. The results were in showing the same patterns as reported by Alquraishi, and Rababah, (2016).

Table 1. Various levels of Lipid profile (mg/dl) in HBE, FBE, and NBE groups containing both genders

Parameters	Gender	Groups			Over all Mean
		HBE	FBE	NBE	
TC	Male	119.67 ^d ±5.02	140.07 ^c ±11.53	162.87 ^b ±19.00	140.87 ^b
	Female	129.13 ^{cd} ±15.39	160.80 ^b ±5.90	206.13 ^a ±24.52	165.36 ^a
TG	Male	122.13 ^{bc} ±97.26	172.00 ^b ±75.18	241.40 ^a ±115.17	178.51 ^a
	Female	107.73 ^c ±43.94	86.33 ^c ±32.18	102.00 ^c ±52.27	98.69 ^b
HDL	Male	36.00 ^{cd} ±8.28	33.66 ^d ±6.10	35.73 ^{cd} ±7.59	35.133 ^b
	Female	39.53 ^{bc} ±6.02	44.73 ^a ±7.14	42.26 ^{sb} ±6.39	42.178 ^a
LDL	Male	69.07 ^{de} ±14.61	91.13 ^{bc} ±29.14	118.20 ^s ±28.00	92.800 ^a
	Female	57.87 ^e ±12.91	77.93 ^{cd} ±8.83	99.80 ^b ±16.43	78.533 ^b
VLDL	Male	22.60 ^c ±11.88	33.60 ^b ±19.64	47.933 ^s ±23.15	34.711 ^a
	Female	20.20 ^c ±8.11	17.06 ^c ±6.25	20.467 ^c ±10.82	19.244 ^b

HBE=Healthy Breakfast eaters; FBE=Fried Breakfast Eaters; NBE=Non Breakfast Eaters; TC=Serum Total Cholesterol; TG= Triglycerides; HDL= High Density Lipoprotein cholesterol; LDL= Low Density Lipoprotein Cholesterol; VLDL= Very Low Density Lipoprotein Cholesterol.

Dietary Assessment

BMI is a measuring technique of weight adjusted for height [weight (kg)/height (m²)]. It is noninvasive, simple and cheaper technique in comparison to other techniques used for measurement of body fat and also a sign of presence of fat levels in body (Taxová Braunerová, 2021). The higher BMI was noted in male (23.87±2.76kg/m²) and (25.380±3.81kg/m²) female population of NBE groups. In gender comparison the results were non-significant among all groups. Females from NBE group were observed with higher BMI followed by males of NBE group. However, non-significant variations were noticed in results based on gender differences. These outcomes were parallel to the results of Sila et al. (2019) who suggested that the breakfast has significant effects on health of people. Another study depicts that the breakfast skippers have greater BMI as compared to healthy breakfast consumers and other breakfast consumers as they skip the breakfast and consume other discretionary foods in higher amounts including fried foods etc. (Fayet-Moore et al., 2019).

Calorie is energy determining unit produced from foods due to presence of various nutrients. One calorie is the total heat required to enhance the temperature of water (1g) by 1°C. The calories production through varies nutrient to nutrient on their burning i.e., 1g of carbohydrates produce 4kcal, 1g protein produce 4Kcal, and 1g fat produce 9Kcal. A proper diet should produce enough calories to retain the healthy life and optimal energy source. The decline in any concentrations of any nutrient intake results in decreased quantity of calories production. Due to this reason, some other foods are necessary to accommodate the deficiency of these foods (Workgroup, 2005). The significant difference was observed in genders and non-significant among the groups for total calorie intake. Maximum calories were

calculated in male population of NBE (2238.8 ± 421.5 Kcal) and lowest value (1696.3 ± 282.81 Kcal) was observed in females of eating fried breakfast. The outcomes of current study were in alignment to the results of Maffeis et al. (2021), depicted the energy consumption pattern among adolescents, children, and adults and suggested that males required higher amounts of cholesterol, fat and energy and lower amounts of fiber and carbohydrates as compared to females.

The lipids are water insoluble that one triacylglycerol combined with 3 fatty acid molecules. Fats are normally solid at room temperature and oils are liquid at room temperature. Fats can be obtained from plants, animals or marine sources. The oils and fats are mostly manufactured from oilseed crops and oil containing fruits of trees. These are utilized in human recipes, various industrial applications, biodiesel manufacturing, and preparation of animal feed. Moreover, these fats play a major role in manufacturing of various products such as infant formulas, confectionery products, dressings, snack foods, baked goods, shortenings, non-dairy creamers, and margarines (FAS, 2011). The fat intake observed in NBE higher was than HBE and FBE groups of males and females. The results were differed significantly on gender basis. The higher amounts of fats in HBE and FBE groups and lower amounts in NBE group were observed in females in comparison to respective male groups. The increase in fat intake level might be due to the eating pattern of Pakistani females who consumes more fats as compared to males. The fats concentrations have statistically difference either in gender or group comparison was conducted. The study conducted by Sigit et al. (2020) depicted that male of any population consume higher amounts of cholesterol and fats than female.

Glucose is a basic component of carbohydrate which provides energy directly to the body on its breakdown (Alemany, 2021). It plays a key role in various functions of red blood cells and brain tissues. The extra amounts of glucose after accomplishing the body requirements convert into glycogen and stored skeletal muscles and liver tissues where it changed into fat (Alghannam, Ghaith, and Alhussain, 2021). The carbohydrates varied significantly with respect to genders and groups. The higher amounts of carbohydrate were noted in males of NBE (64.53 ± 2.26 g) followed by FBE (62.66 ± 2.05 g) and HBE (57.66 ± 1.44 g). The same sequence was observed in females. However, the males showed the higher amounts than females respectively. The WHO report of 2009 and 2003 depicted the same results.

Proteins are macromolecules formed with the combination of various amino acids and are building blocks of body muscles and body cells. The same amino acids are present in proteins of bacteria cells (LaPelusa, Andrew, and Kaushik, 2020). The large amounts of proteins are required for the growth of body and are considered second abundant component of body followed by water. Furthermore, hairs, skins, eyes and entire body organs are developed from proteins. Enzymes and hormones regulating the various body functions are also formed by proteins. Furthermore, it plays pivotal role in development of blood cells and antibodies to defend body mechanisms from illnesses, infections and various diseases (Whitney and Rolfes, 2015). The protein concentrations were varied significantly between groups and

gender. The proteins values were observed highest in FBE followed by HBE and NBE in both genders. However, protein concentrations were higher in males of FBE group and lower in HBE and NBE groups in comparison to females of respective groups. In another study, same relationship was observed between dietary protein level and gender difference (Casperson and Roemmich, 2017). Moreover, the same trends were observed in study reported by European health and nutrition department (Elmadfa and Kornsteiner, 2009).

Table 2. Dietary assessment of All Groups (HBE, FBE, and NBE) and Gender.

Parameters	Gender	Groups			Overall Mean
		HBE	FBE	NBE	
BMI (kg/m ²)	Male	20.560 ^b ±1.56	20.967 ^b ±1.88	23.887 ^a ±2.76	21.804 ^a
	Female	20.220 ^b ±1.82	20.613 ^b ±1.96	25.380 ^a ±3.81	22.071 ^a
Total Calories (Kcal)	Male	1890.6 ^b ±147.2	1887.9 ^b ±166.2	2238.8 ^a ±421.6	2005.8 ^a
	Female	1721.1 ^b ±272.2	1696.3 ^b ±282.8	1719.2 ^b ±690.3	1712.2 ^b
Total Fat (g)	Male	17.800 ^f ±1.20	24.933 ^d ±1.48	34.667 ^a ±2.87	25.800 ^a
	Female	19.533 ^c ±0.91	26.553 ^c ±0.91	31.800 ^b ±1.52	25.962 ^a
Total Carbohydrates (g)	Male	57.667 ^d ±1.44	62.667 ^b ±2.05	64.533 ^a ±2.26	61.622 ^a
	Female	57.200 ^d ±1.56	59.733 ^c ±1.53	60.420 ^c ±1.52	59.118 ^b
Total Proteins (g)	Male	21.067 ^a ± 2.18	33.600 ^b ±1.26	13.067 ^d ±1.09	16.311 ^b
	Female	21.133 ^a ±1.59	17.867 ^b ± 1.30	13.400 ^d ±2.29	17.467 ^a

HBE=Healthy Breakfast eaters; FBE=Fried Breakfast Eaters; NBE=Non Breakfast Eaters; TC=Serum Total Cholesterol; TG= Triglycerides; HDL= High Density Lipoprotein cholesterol; LDL= Low Density Lipoprotein Cholesterol; VLDL= Very Low Density Lipoprotein Cholesterol.

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Conflicts of interest

There is no conflict of interest between the authors of the article.

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