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FAT AND FATTY ACID COMPOSITION OF SELECTED REGULAR AND HEALTHY FAST FOODS IN AMMAN, JORDAN

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ABSTRACT

Fast food is a food that is timely and easily prepared and consumed. Generally, it is made of cheap and low nutritional value ingredients. The aim of this study is to determine the fat and the fatty acid composition of regular and healthy fast foods in Amman, Jordan. Thirty-six samples of different fast-food items were collected from three regular fast-food restaurants. Twelve samples were bought from a healthy fast-food restaurant. The results showed that the highest fat content among regular samples was in chicken burger (CB) 12.022% but it was the lowest in turkey sandwich (T) 5.13%. Total fat was lower in healthy items. The highest amount of fat was in healthy chicken pizza (IPH) 6.62%, while baked potato (BP) showed the lowest fat content (0.27%). Halloumi sandwich (H) recorded the greatest level of saturated fatty acids (SFA) 67.01%, yet the lowest was in beef shawarma (BS) 28.30%. Healthy halloumi (HH) recorded the greatest level of SFA (69.45%) where it was the lowest in BP (20.60%). The greatest monounsaturated fatty acids (MUFA) content was in BS (42.88%), however its lowest content was in cheese pizza (EP) 26.31%. The highest content of MUFA was in healthy chicken fajita (HCF) 55.33% while its lowest was in HH (27.24%). The highest polyunsaturated fatty acids (PUFA) content was recorded by chicken shawarma (CS) 34.45% where it was the lowest in H (5.29%). The highest PUFA content was in samples containing meat. The greatest PUFA content was recorded in healthy turkey (HT) 38.01%, whereas it was the lowest in HH (5.20%). The highest level of trans fatty acids (TFA) was observed in French fries (FF) (0.72%), while its lowest amount was in chicken burger (CB) (0.12%). The highest TFA level was in HT (0.86%) while its lowest amount was in BP (0.11%). The ω-6/ω-3 in regular samples was from 5:1 for (CS) to 36:1 for (FF). Nevertheless, ω-6/ω-3 ranged from 1:1 to 22:1 for healthy beef quesadilla (HBQ) and HH in healthy samples. It was found that ω-6/ω-3 in healthy samples was lower than regular ones. The PUFA/SFA ranged 0.08 - 1.25 for H and BS. Whereas, the PUFA/SFA ranged 0.07 - 1.59 for HH and BP in healthy samples. Among the regular samples, the highest atherogenic index (AI) and thrombogenic index (TI) were in H (2.54 and 3.06). The lowest AI and TI were in BS (0.47) and CS (0.54). The highest AI and TI were in HH (2.91 and 3.46) in healthy samples, whereas the lowest AI and TI were in BP 0.26 and 0.49.

Key words: Jordan, fast-food, regular, healthy, fat content, fatty acid composition

INTRODUCTION

Fast food is a food that is timely and easily prepared and consumed. It is typically sold in restaurants and offered in a packaged form for take-out [1]. Fast food industry is not new since it dates back to the ancient cultures. For example, there were bread and olive stand in ancient Roman civilization, noodle shops in ancient East Asia, and flat bread and falafel in the Middle East [2]. Generally, fast food is prepared using cheap precooked items of low nutrition value [3]. This kind of food stuff was designed for commercial objectives to fulfil the customer's demand, especially travelers and wage workers who did not have time to sit and eat in restaurants [4]. Nowadays, fast-food phenomenon is growing drastically. Its popularity stems from containing a mixture of tasty ingredients, particularly sugar, fat and salt. These components make the food more palatable and desirable by consumers [5]. Besides, busy lifestyle leads working individuals to consume convenient and readily cooked food [6]. Consumers are also exposed to advertisement everywhere on TV, internet and so on. It is believed that advertising is a successful tool to raise sales volume. It was pointed out that advertising may raise sales volume if it targets to alter consumer choices and to inform customer. In brief, advertising impacts sales volume effectively when it reflects a good reputation of the firm and the high quality of its products. Globalization has noticeably affected individual lifestyle. It induces eating, dressing and recreation patterns to be worldwide alike. As a result, fast food consumption is growing day after day [4]. Recently, fast food outlets support their business using e-commerce apps which stimulate people to purchase fast food more and more because of its simplicity and convenience [7]. During the COVID-19 pandemic, e-commerce thrived due to the contactless delivery and online payment options [4]. Jordan was also affected by the changes in lifestyle and eating patterns. Thus, a noticeable tendency of Jordanians to western diet has been documented [8]. Fast food menu involves pizza, burgers, fried chicken, French fries, and shawarma sandwiches [3]. Eating fast food frequently had been accompanied by low consumption of fruits, vegetables and milk but high fats, carbohydrates and added sugars intake [9]. Fast food meals are calorie-dense as they provide one-third to one half of daily energy but below quarter of micronutrients [10]. The large amounts of lipids that fast foods involve have been associated to the risk of developing several non–communicable diseases including obesity [9]. Consumers are actually more conscious about the relationship between diet and health. Thus, many of them pay attention to the health claims and nutrient content when purchasing food [11]. To meet customers, demand for nutritional, fast and convenient food, many fast food restaurants added a range of healthier options to their menus such as salads, whole grains and lean meats [6]. While others adopted alternative cooking methods like boiling and baking, they substituted French fries by baked potato [12]. In addition, dietary

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recommendations motivate people to bring some modifications to their diet such as substituting white bread by whole wheat bread, regular ground beef by lean ground beef and whole fat milk by low-fat milk [13].

The present study aims to determine the fat content and the fatty acid composition of selected regular and healthy fast food in Amman city. In addition, the health indices such as omega-6/omega-3 ratio, Atherogenic Index (AI), Thrombogenic Index (TI) and PUFA/ SFA ratio were calculated according to the obtained results. Results of regular and healthy fast foods were compared.

MATERIALS AND METHODS

SAMPLING METHOD

Samples were purchased from fast food restaurants inside and near the University of Jordan. Regular fast food items represent the main highly consumed options such as French fries, burger, pizza and shawarma by college students (A short oral questionnaire was performed). Some Mexican food like quesadilla and fajita were also chosen in order to provide a data base for future researches. Healthy fast food alternatives were bought from healthy fast food restaurants. Sampling was implemented every week starting from January, 2022.

SAMPLE PREPARATION

Thirty-six samples were purchased from three regular fast-food restaurants and twelve samples from one healthy fast-food restaurant (it provides information about the nutritional contents of the food items it serves on the menu) in Amman city, Jordan. Regular samples included French fries, beef quesadilla, chicken quesadilla, beef burger sandwich, chicken burger sandwich, chicken pizza, cheese pizza-marguerite, chicken fajita, turkey sandwich and halloumi sandwich, chicken shawarma and beef shawarma. Healthy items comprised of baked potato, healthy beef quesadilla, healthy chicken quesadilla, healthy beef burger, healthy chicken burger, healthy chicken pizza, healthy cheese pizza-marguerite, healthy chicken fajita, healthy turkey, healthy halloumi, healthy chicken shawarma and healthy beef shawarma. Regular (traditional and westernized fast foods) and healthy samples were blended separately and placed in labeled containers then stored in the freezer till the analysis time. Three samples of each type were blended together to provide a single sample. All parameters were measured as triplicate to which mean values were calculated.

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FAT DETERMINATION

Basing on the prepared samples mentioned above, the fat composition of both regular and healthy fast-food was determined by using Soxhlet extraction method according to the AOAC Official Method 963.15 [14].

FATTY ACID PROFILE

Fatty acid methyl esters were prepared conforming to EC Regulation no. 2568/91 method [15], by: weighing 50mg of fat in a labelled ampoule of 5mL volume, 2 mL of hexane used to dissolve fat and 200 µL of methanolic potassium 2N were added, followed by shaking for 30 seconds. After that, a volume of 200 µL of acetic acid was added and the whole was shaken for 30 seconds. A volume of 1 µL of the supernatant was taken using a GC syringe and injected in the GLC apparatus (model GC-2010, Shimadzu. Inc., Koyoto, Japan).

By employing a capillary GLC column (Restek, Rtx-225, USA, cross bond 50%-cyanopropylmethyl 50%-phenylmethyl polysiloxane, 60 m, 0.25 mm/D, 0.25µm df), the determination of the fatty acid profile was assessed in triplicate and GLC conditions were set according to sample composition regarding milk fat and non-milk fat ingredients. For samples containing milk fat, the initial column temperature was 70˚C held for 2 min followed by raising temperature: 15˚C till 165˚C with holding time of 8 min, 1˚C till 180 ˚C then 5 ˚C till 230 ˚C held for 10 min. The total analysis time was 31.5 min. For samples without milk fat, the initial column temperature was 165˚C held for 4 min followed by raising temperature: 2˚C/min till 180 ˚C, then increasing temperature 5˚C/min till 230˚C held for 10 min. The total analysis time was 53.33 min. The split ratio was 60, the flow rate was 1.2 mL/min, injector and detector temperatures were 250˚C. Fatty acids concentrations were determined using chromatogram of fatty acid standard.

INDICES OF LIPID HEALTH QUALITY

Quality of lipids in different oils and fats is determined by prominent indices including atherogenicity (AI) and thrombogenicity indices (TI). They are used to estimate the effect of fatty acids on human health especially cardiovascular diseases. Atherogenic index shows the relation between both proatherogenic fatty acids comprising myristic, palmitic and stearic acids and antiatherogenic unsaturated fatty acids. Whereas thrombogenic index indicates the relation between antithrombogenic unsaturated fatty acids and prothrombogenic saturated fatty acids. Atherogenic index is used as an indicator for atherosclerosis whereas formation of clots in blood vessels is represented by thrombogenic index [16]. These indices were calculated according to the following formulas:

a) Index of atherogenicity (IA):

IA = [(4×C14:0) + C16:0 + C18:0 / [ΣMUFA + PUFA – n6 + Σ PUFA- n3]

b) Index of thrombogenicity (IT):
IT= C14:0 + C16:0 + C18:0 / 0.5 ×MUFA+ 0.5 × PUFA- n6 + 3× PUFA- n3 / PUFA – n6) [17].

STATISTICAL ANALYSIS

To assess significant differences between means of fat, fatty acid profile (SFA, MUFA, PUFA and TFA) and the indices of lipid health quality (AI and TI), one-way (ANOVA) was carried out using IBM SPSS statistical software release 22.0. Duncan test was performed to determine significantly different means (α= 0.05). In the present study, all parameters were measured as triplicate to which mean values were calculated.

RESULTS AND DISCUSSION

FAT CONTENT

The fat content of the analyzed regular and healthy samples is summarized in figures 1 and 2, respectively. The highest amount of fat among regular fast food samples was obtained from chicken burger (CB) that was 12.02%, but the lowest fat content was shown in turkey (T) sandwich (5.13%). Fat is the richest source of calories. The amount of energy it produces is 9 kcal/g which is double the amount generated from either proteins or carbohydrates. Therefore, reducing fat consumption is recommended [18].

The fat content of CB (12.02%) was lower than that reported by Musaiger & D`souza. [19] 15.10%, while it is higher than the result obtained by Daili *et al*. [20] 9.81%. Beef burger showed a fat content of 9.45% which is lower than the fat content found by Musaiger & D`souza. [19] 13.0% but higher than the findings of Yagope *et al*. [21] 6.72%-7.85%. Factors such as animal origin, diet, age beside the amount of water added to burger formulation affects its fat content [22]. Musaiger *et al*. [23] reported that FF contained (17.33%) of fat which is higher than our finding (9.85%). Many studies showed that significant loss of moisture during frying resulted in the uptake of fat by the potato. In FF, fat content is mainly related to the amount of fat absorbed during frying while fat uptake is influenced by: oil quality, frying temperature and duration, type of food product [24]. Baked potatoes are recommended as substitute of French fries because baking is a healthier cooking technology than frying, as it is performed without oil [25].

Beef shawarma showed 9.29% fat which is higher than the findings of Ahmed *et al*. [26], 9.21% (p-value < 0.05) and Hoteit *et al*. [27] 8.2%. Beef quesadilla contained 10.50% and CQ contained 8.24% fat which is higher than that reported by

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Morales-Guerrero *et al*. [28] 6.9%. Differences in chicken fat are due to the use of different chicken parts (breast, leg), gender and age [29]. In addition, variation in beef fat is also due to the use of diverse beef cut such tenderloin (55.66% fat), rib (47.73%) and loin (41.58%) [30]. Fat content in CF was 7.52%. Chicken shawarma presented a fat content of 7.51% which is lower than the finding of Takruri *et al*. [31] 10.05% and Ahmed *et al*. [26] 10.38% but higher than the result recorded by Hoteit *et al*. [27] 6.94%. Hocine *et al*. [22] reported that the fat variations in shawarma are referred to the use of chicken skin and different chicken species beside fat loss during cooking.

Musaiger & D`souza. [19] found that IP had a fat content of 8.90% which is higher than our finding 7.68%. Durazzo *et al.* [32] reported a fat content of 9.30% for EP which is higher than our result 8.71%. Fat from pizza is obtained mainly from cheese and meat which are used as toppings [19]. Daili *et al*. [20] reported that T and H contained 6.32% and 12.21% fat, respectively which are not in agreement with our results 5.13% and 7.01%, respectively. Differences in T are due to sandwich ingredients and type of meat used [33]. Because halloumi cheese is the major ingredients responsible of fat content in halloumi sandwich, differences in fat content are attributed to cheese composition [20].

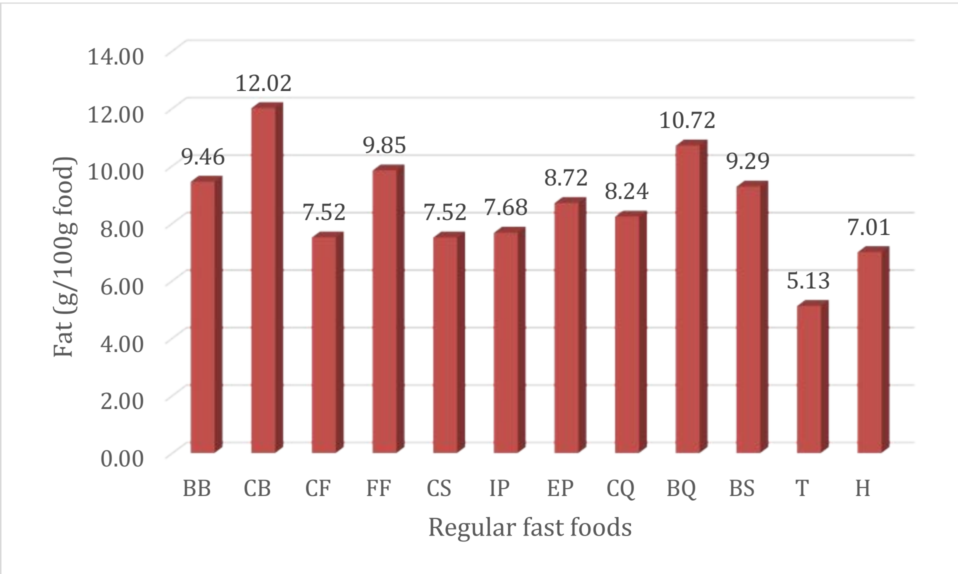

Figure 1: Fat content (g/100g food) of selected regular fast-food in Amman
BB: Beef burger, CB: Chicken burger, CF: Chicken fajita, FF: French fries, CS: Chicken shawarma, IP: Chicken pizza, EP: Cheese pizza, CQ: Chicken quessadilla, BQ: Beef quessadilla, T: Turkey sandwich, H: Halloumi sandwich

According to the findings of this study (figure 2), the healthy sandwiches showed a significantly noticeable lower fat content compared to regular sandwiches. The higher amount of fat was obtained from IPH (6.62%) and followed by HH (6.27%). Lower fat content was presented by HBS (5.70%) and HBB (2.91%) and HCF

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(1.09%). Remarkably no significant differences were recorded between IPH and HBQ, between HH and EPH and also for HBB, HCB and HCS. Both BP and HT presented traces of fat, yet BP showed the lowest fat content 0.27%. When comparing the analyzed regular fast foods to the healthy fast foods showed generally lower fat content. So, healthy fast foods are good alternatives of regular fast foods.

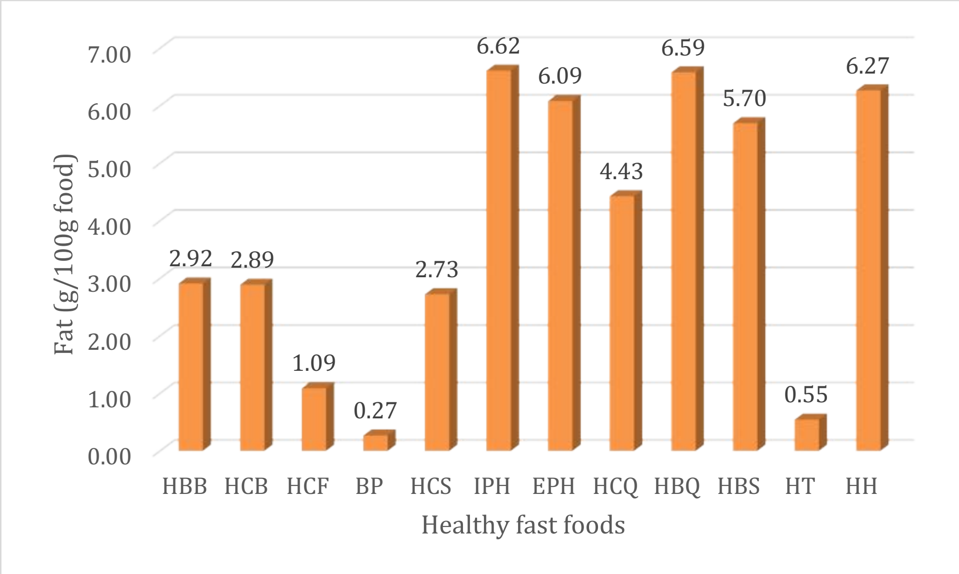

Figure 2: Fat content (g/100g food) of selected healthy fast-food in Amman

HBB: Healthy beef burger, HCB: Healthy chicken burger, HCF: Healthy chicken fajita, BP: Baked potato, HCS: Healthy chicken shawarma, IPH: Healthy chicken pizza, EPH: Healthy cheese pizza, HCQ: Healthy chicken quesadilla, HBQ: Healthy beef quesadilla, HT: Healthy turkey sandwich, HH: Healthy halloumi sandwich.

FATTY ACID COMPOSITION

Saturated fatty acids (SFA)

Tables 1 and 2 present the saturated fatty acids (SFA) content in the analyzed samples. According to Table 1, the highest SFA amount belonged to palmitic acid ranging from 40.37% to17.31%, followed by stearic acid and myristic acid. The highest quantity of palmitic acid C16:0 was observed in (H and EP) (40.37% and 30.85%) followed by (FF and IP) (30.11% and 29.47 %, respectively) while its lowest levels were found in CF (17.31%). Palmitic acid is the main SFA in dairy products which explains the high content of H and EP in palmitic acid [34]. Moreover, the high palmitic acid content in FF indicates that potatoes were fried in palm oil [35]. Palmitic acid is the highest SFA in chicken which justified its prevalence in IP [34]. While, the lowest palmitic acid in CF is due to combination of chicken meat and vegetables [19]. The high amounts of stearic acid C18:0 were recorded from (BB and BQ) (11.57% and 10.81%) followed by (IP and CQ) (8.78% and 8.10% respectively), where its lowest quantity was in (FF) (4.47%). Samples containing beef and chicken showed high stearic acid content because it is one of the most abundant SFA in meat [23]. The highest levels of myristic acid C14:0 were observed in (EP and T) (10.83% and 7.26%) followed by (CS and BB) (5.76% and 3.16%, respectively) with its lowest amount in (FF) (0. 56%). High myristic acid in EP, T, CS and BB is due to the use meat and cheese in these fast foods [18]. French fries showed low stearic and myristic acids as vegetables are poor in fat and fatty acids [20]. Halloumi sandwich, EP, BQ and T recorded the greatest levels of SFA (67.01%, 63.58%, 52.71% and 48.21%, respectively), while it was the lowest in BS (28.30%). The levels of lauric acid C12:0 were highest in (EP and H) (3.39% and 2.65%) followed by (T and BQ) (2.28% and 1.79%, respectively) whereas it was found in slight amount in BS (0.18%). Results showed that the most prevalent SFAs among the analyzed fast food samples were: palmitic, stearic and myristic which are consist with the findings of Maldonado- pereira *et al*. [18].

Healthy fast foods showed lower SFA content compared to regular fast foods. The highest saturated fatty acid amount was recorded from palmitic acid ranging from (34.91% to 14.64%), followed by stearic acid and myristic acid. The highest quantity of palmitic acid C16:0 was observed in (HH and CQH) (34.91% and 31.09 %) followed by (HBQ and IPH) (28.84% and 24.51%, respectively) while its lowest levels were found in HBS (14.64%). The high amounts of stearic acid C18:0 were recorded in (HBQ and HH) (12.61% and 11.31%) followed by (HBS and EPH) (10.23% and 9.01%, respectively) where its lowest quantity was in BP (4.12%). Generally, the results obtained by Yagope *et al*. [21] showed that SFA is the main FA in beef burger.

The highest levels of myristic acid C14:0 were observed in (HH and EPH) (12.05% and 9.51%) followed by (IPH and HBQ) (7.18% and 6.60%, respectively) with its lowest amount in BP (0.34%). Healthy halloumi, EPH, HBQ and HCQ recorded the greatest levels of SFA (69.45%, 58.63%, 55.24% and 49.93%, respectively) where it was the lowest in BP (20.60%). The great levels of palmitic acid in fast food are due to the fact that the main SFAs present in meat are palmitic acid and stearic acid [23]. Unlike other long- chain SFAs, stearic acid has no effect on the total cholesterol and lipoprotein cholesterol concentrations in men and women. So, it does not exert an adverse effect on health [36]. Papotti *et al.* [34] reported that after its absorption in human body, palmitic acid exerts its LDL-raising effect for short time because it is converted to oleic acid through elongation and desaturation reactions.

The levels of lauric acid C12:0 were highest in (HH and EPH) (3.51% and 3.02%) followed by (IPH and HCQ) (1.95% and 1.54%, respectively) whereas it was found in slight amount in HCF (0.10%). Lauric acid is known to exert a prominent hypercholesterolemic effect in humans [35]. Butyric, caproic, caprylic, capric, margaric and arachidic acids were found in low quantities in both regular and healthy fast food samples. A study conducted by Papotti *et al.* [34] pointed to the low quantities of those fatty acids in diet. Butyric acid was documented to show positive effect on health such as cancer prevention [36], protection against different CVD-related conditions by affecting glucose and lipid homeostasis and immune cell activation [34].

The effect of SFA on serum cholesterol levels in humans depends on the length of the carbon chains of fatty acids [36]. Lauric (C12:0), myristic (C14:0), and palmitic (C16:0) SFAs show a tendency to increase the hematic cholesterol concentration [34]. Myristic acid has a hyper-cholesterolemic effect of four folds higher than palmitic one, while stearic acid is considered neutral [17]. Excessive consumption of SFAs could cause an increase in blood cholesterol levels. As they accumulate simply on the walls of arteries causing an increase in blood cholesterol, which is associated with an increased risk of cardiovascular disease development [16].

Monounsaturated fatty acids (MUFA)

Table 3 and table 4 summarize the monounsaturated fatty acids (MUFA) content in the analyzed regular and healthy samples. Oleic acid C18:1 was the highest among the detected MUFA in the regular fast-food samples, it ranged between (41.64% and 24.27%), followed by low quantities of palmitoleic acid C16:1 and slight levels of heptadecenoic acid C17:1. The abundance of oleic acid in fast food was also reported by Daili *et al*. [20]. The greatest oleic acid quantities were shown by (CF and CB) (41.64% and 36.66%) followed by (BB and H) (35.01% and 27.13%, respectively) where its lowest quantity was shown by (EP) (24.27%). The greatest total MUFA content was presented by (BS and CS) (42.88% and 38.73%) followed by (BB and H) (36.99% and 29.69%, respectively) whereas its lowest content was shown by (EP) (26.31%). In addition, oleic acid C18:1 showed the highest amounts among the detected monounsaturated fatty acids in the healthy fast food samples but in higher levels when comparing with regular fast food samples, it ranged between (53.23% -24.98%), followed by low quantities of palmitoleic acid C16:1 and slight amounts of heptadecenoic acid C17:1. The greatest quantities of oleic acid were shown by (HCF and HCB) (53.23% and 51.22%) followed by (BP and HBS) (47.55% and 44.21%, respectively) whereas the lowest levels were in (HH) (24.98%). The highest total content of MUFA was detected in (HCF and HCB) (55.33% and 52.77%) followed by (BP and HBS) (49.04% and 45.41%) while its lowest was in (HH) (27.24%). Oleic acid C18:1 is a primary MUFA, it represents about 33% of fatty acids composition in beef [21]. Monounsaturated fatty acids are thought to be the healthiest among the dietary fats [37]. Oleic acid is ubiquitous as it may be obtained from many vegetables and animals [34]. It is thought that oleic acid assists in strengthening the aromatic properties in food [17]. Regarding health outcomes, it was revealed that replacing foods with high SFA by foods high in oleic acid particularly in high-oleic sunflower oil and margarine has a beneficial effect on blood lipids [23]. In addition, a study conducted by Musaiger *et al*. [23] showed that substituting linoleic acid by oleic acid in the diet led to a positive effect on both LDL and HDL levels in patients suffering from diabetes. It was also documented that oleic acid exhibited anti-cancer, anti-atherogenic effects [36] protective influence against cardiovascular diseases [17].

Polyunsaturated fatty acids (PUFA)

Table 5 presents the polyunsaturated fatty acids (PUFA) recorded from regular fast-food samples and Table 6 presents the PUFA recorded from healthy fast-food samples. According to Table 5 the most abundant PUFA in the analyzed regular samples was the linoleic acid C18:2 ranging from (28.38% to 4.59%). The greatest levels of linoleic acid C18:2 were observed in (BS and FF) (28.38% and 25.91%) followed (CQ and EP) (18.65% and 10.44, respectively) while its lowest was found in (H) (4.59%). Moreover, High linoleic content in FF indicates that the frying oil is a blend of palm oil with another vegetable oil which is high in PUFA such as canola oil [38]. The highest PUFA content was recorded in (CS and BS) (34.45% and 31.07%) followed by (CF and CQ) (30.09% and 20.18%) where it was the lowest in (H) (5.29%). Chicken meat contains higher PUFA than beef meat [20]. Thus, fast foods containing chicken showed the highest PUFAs content. Daili *et al*. [20] reported that the high amount of PUFA in BS is due to the combination of chicken and beef meats. The results of the present study showed that the main PUFAs in all the analyzed regular samples were linoleic and linolenic acids which are in good accordance with the findings of Hocine *et al*. [22]. The most abundant PUFA in the analyzed healthy samples was the linoleic acid C18:2 ranging from 35.13% to 4.97%. According to Yeo *et al*. [38], LA is 5-20 times higher than ALA in human diet. The greatest levels of LA were observed in (HT and BP) (35.13% and 31.10%) followed (HBS and HCF) (28.05% and 20.14%, respectively), while its lowest amount was found in HH (4.97%). The highest PUFA content was recorded in (HT and BP) (38.01% and 32.75%) followed by (HBS and HCS) (29.61% and 23.51%, respectively) where it was the lowest in (HH) (5.20%). Dairy products are low in PUFA content [18] which justifies the low amount of PUFA in HH. The prevalent fatty acids in potato tubers are LA which represents 50% of total fatty acids followed by ALA with 20% [39]. Therefore, BP showed high LA and PUFA contents. Alpha linolenic acid (C18:3) is important to help protect against cardiovascular disease CVD, neurodegeneration and inflammation [38]. Polyunsaturated fatty acids are defined as essential fatty acids since the human body is incapable to synthesize them [27]. Linoleic acid and ALA are precursors of long chain PUFAs synthesis in human body involving two enzymes namely elongase for carbon chain elongation, and desaturase for desaturation [17]. As a result of elongation and desaturation, eicosapentanoic acid (EPA) (C20:5ω3) and docosahexaenoic acid (DHA) (C22:6ω3) are derived from ALA while arachidonic acid (C20:4ω6) is derived from LA [40]. The health benefits of ω-3 PUFAs are summarized in the protection against CVD, decreasing the susceptibility to mental illness, improve eye function in infants and alleviation of rheumatoid arthritis symptoms [17].

Trans fatty acids (TFA)
Figures 3 and 4 show the TFA content in the analyzed regular and healthy (FF) samples. In regular (FF) samples, TFA ranged from 0.72% to 0.12%. The highest levels of TFA were observed in (FF and T) (0.72% and 0.52%) followed by (BQ and CS) (0.49 % and 0.36%, respectively), while its lowest amounts were shown by (CB) (0. 12%). French fries contained 0.72% TFA which is higher than the result found by Tuburczy *et al*. [41] 0.66%. Astiasaran *et al*. [42] reported that the increase in TFA in French fries is due to the repeated use of the same frying oil. Turkey sandwich showed TFA content of 0.52% which is lower than that obtained by Daili *et al*. [20] 1.30%. Turkey sandwich is made of many vegetables beside bread and turkey [43]. As a result, different proportions of ingredients alter its chemical composition. Beef quesadilla showed TFA content of (0.49%) which is higher than the finding of Angell *et al*. [44] 0.41% for Mexican foods while this value is higher than the TFA content of CQ and CF (0.40%-0.25%). This is due to variation in their ingredients (vegetables and meats). Trans fatty acid content in CS was 0.36% which is lower than that obtained by Daili *et al*. [20] 0.96%. Beef shawarma contained 0.25% TFA which is lower than the result of Hocine *et al.* [22] 3.08%. Trans fatty acid percentage was 0.12% in CB and 0.37% BB which are lower than the findings of Hocine *et al*. [22] CB 1.09% and BB 2.80%. Differences in TFA amount in chicken burger is due to variation in species and the use of chicken skin. In addition, ruminant meats contain higher TFA than chicken meat [20]. Trans fatty acids amount in EP was 0.64% and in IP was 0.64% (P=0.02) which is higher than the result of Angel *et al*. [44]. This is due to the use of partially hydrogenated oils and differences in cheese [20].

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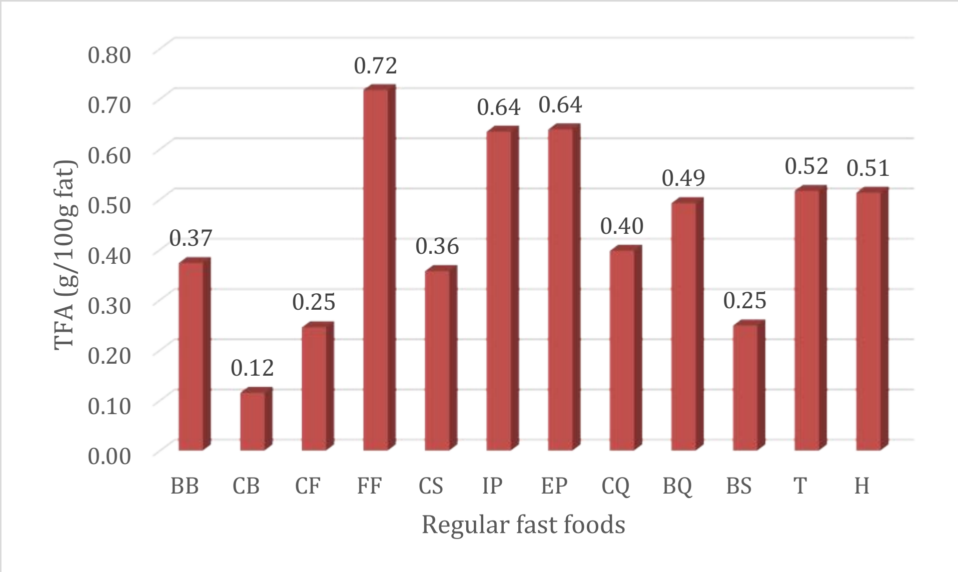

Figure 3: TFA content (g/100g fat) in regular fast-food in Amman

BB: Beef burger, CB: Chicken burger, CF: Chicken fajita, FF: French fries, CS: Chicken shawarma, IP: Chicken pizza, EP: Cheese pizza, CQ: Chicken quesadilla, BQ: Beef quesadilla, BS: Beef shawarma, T: Turkey sandwich, H: Halloumi sandwich.

In healthy samples, TFA ranged from 0.86% to 0.11%. The highest levels of TFA were observed in (healthy turkey and healthy cheese pizza) (0.86% and 0.72%) followed by (HCQ and IPH) (0.61% and 0.54%, respectively) while its lowest amounts were shown by BP (0.11%). Trans fatty acids mainly occur as a result of industrial and biological hydrogenation of fat [45]. Consumption of high amounts of TFA contributes to higher susceptibility to CVD, increase LDL and reduce HDL cholesterol concentration, they are also considered as markers of inflammation [46].

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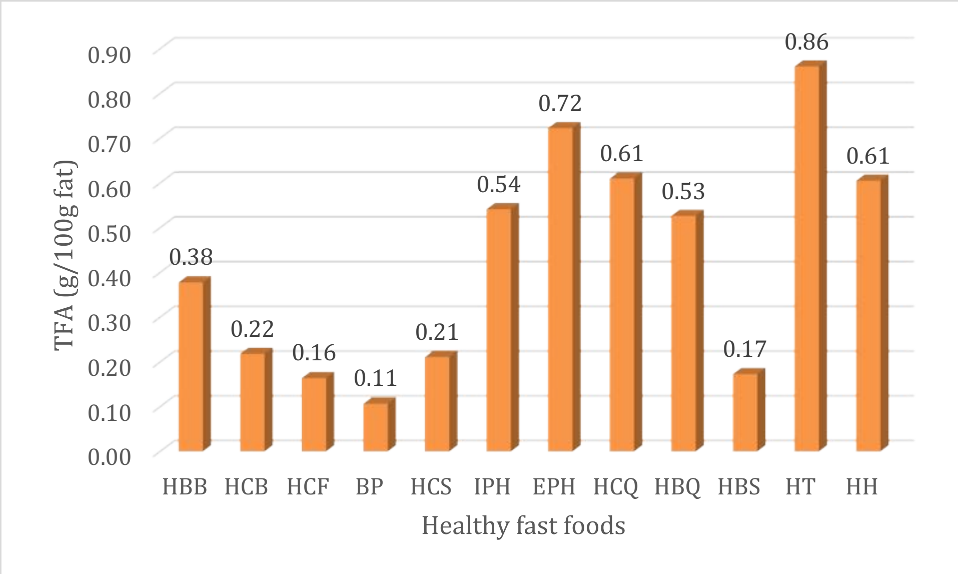

Figure 4: TFA content (g/100g of fat) of healthy fast-food in Amman

HBB: Healthy beef burger, HCB: Healthy chicken burger, HCF: Healthy chicken fajita, BP: Baked potato, HCS: Healthy chicken shawarma, IPH: Healthy chicken pizza, EPH: Healthy cheese pizza, HCQ: Healthy chicken quesadilla, HBQ: Healthy beef quesadilla, HBS: Healthy beef shawarma, HT: Healthy turkey sandwich, HH: Healthy halloumi sandwich.

INDICES OF LIPID HEALTH QUALITY

Omega-6/Omega-3

According to Tables 7 and 8, ω-6 PUFAs were higher than ω-3 ones in all the analyzed samples. The ω-6/ω-3 ratio was from 5:1 to 36:1 where the lowest value refers to (CS) and the highest belongs to (FF) in regular samples. Whereas it was from 1:1 to 22:1 in healthy samples where the lowest value belongs to (HBQ) and the greatest one refers to HH. Generally, the ω-6/ω-3 ratio in healthy samples was lower than regular ones. It was revealed that a parallel increase in omega-6 intake and decrease in omega-3 intake was accompanied with high susceptibility to develop CHD worldwide [47]. In terms of quantities, it is recommended for adults to daily consume 2g of ALA, 10 g of LA and 100-200mg DHA [16]. High omega-6 PUFAs and great ω-6/ω-3 ratios are thought to assist in the development of CVD, cancer, inflammatory and autoimmune diseases. In contrast, low ratio of ω-6/ω-3 with high levels of ω-3 PUFA are thought to exert a protective effect [36], [16]. As nutritionists consider high consumption of omega-6 undesirable and recognizing diet enrichment with omega-3 as high nutritional and curing diseases. The suitable ratio of ω-6/ω-3 in the diet should be 5:1[47], but the optimal advised is 1:1 to 4:1 [16].

Polyunsaturated fatty acids/ saturated fatty acids (PUFA/ SFA) ratio

The PUFAs are primarily extracted from different parts of plants [47]. Omega-3 PUFAs are necessary for maintaining human health as they reduce blood cholesterol showing protective action against CVD. SFA are mainly found in animal fat and some vegetable oils such as coconut and kernel oils, the risk factor of SFA is displayed by their facile accumulation in the arteries 'walls [17]. According to table 9 and table 10 PUFA/SFA ratios ranged between (0.08) for (H) to (1.25) for (BS). All of (BB, CB, CF, FF, CS, CQ, BS) and (T) had PUFA/SFA ratio higher than (0.4), but (IP, EP, BQ) and (H) had PUFA/SFA ratio lower than (0.4) in regular samples. Low PUFA/SFA ratio is justified by condensed utilization of animal fat rather than vegetable oils [27]. Also, it was reported that long frying time increases the amount of SFA and decreases the PUFA levels because of the LA and ALA degradation resulting in SFA with lower or same carbon atoms [38]. On the other hand, the PUFA/SFA ratio ranged between (0.07) for (HH) to (1.59) for (BP) in healthy samples. Samples having PUFA/SFA ratio less than the recommended value were higher in healthy samples comparing with regular samples. Lean meat presents greater PUFAs and lower SFA amounts comparing to untrimmed meat. The abundant PUFAs in meat are LA and ALA. Meat fat contains 37% of SFA. Thus, removing visible fat from meat consequently decreases SFA and cholesterol concentrations in meat [19]. To fulfill nutritional requirements, it is worthy to incorporate lean meat and low-fat dairy products in diet with suitable amounts [23].

Atherogenic and thrombogenic indices

Indices of lipid health quality are shown in Tables 9 and 10 for regular and healthy fast- food samples, respectively. Among the regular fast food samples the highest AI and TI were observed in (H) (2.54 and 3.06, respectively), followed by (IP, BQ and BB) with AI (1.72, 1.37 and 0.72, respectively) and TI was (2.37, 1.84 and 1.71, respectively) for (EP, IP and BQ) where the lowest value for AI in (BS) (0.47) and for TI in (CS) (0.54). Among the healthy fast food samples the highest AI an TI were observed in (HH) (2.91 and 3.46, respectively), followed by (EPH, HBQ and HCQ) with AI (1.74, 1.45 and 1.17, respectively) and TI (1.94, 1.55 and 1.39, respectively) for (EPH, HCQ and IPH), where the lowest values for AI and TI were in (BP) (0.26 and 0.46, respectively). Lauric (C12:0), myristic (C14:0) and palmitic (C16:0) SFAs show a tendency to increase the hematic cholesterol concentration (myristic is the most atherogenic) [36], while there is a very high correlation between the sum of the three acids (myristic, palmitic and stearic) and the thrombus formation. Myristic acid has a hyper-cholesterolemic effect of four folds higher than palmitic one, while stearic acid is considered neutral [17]. Many SFAs cause a raise in blood cholesterol level because they are easily deposited on the walls of the arteries. Atherogenic index (AI) and thrombogenic index (TI) reflect the different effects that particular fatty acid might have on human health. Atherogenic index (AI) represents the connection between the main SFA: Lauric, myristic, and palmitic known as proatherogenic and unsaturated fatty acids known as antiatherogenic. It is recognized as a preliminary indicator of developed atherosclerosis relevant to many inflammatory paths. Thrombogenic index (TI) indicates the relation between SFA recognized as prothrombogenic and UFA of all unsaturation degrees recognized as antithrombogenic [16]. It contributes in predicting the likelihood of clot formation in blood vessels [48]. A study conducted by Tilami & Kourimska. [16] reported that climatic region and locality affects fatty acids content and as a result the atherogenicity and thrombogenicity of plant lipids. The higher the AI, the more atherogenic dietary components there are. Foods with low levels of AI and TI (less SFA) have a greater potential for protection against coronary artery diseases [48].

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

From the results of the present study, regular samples have higher fat content compared to healthy fast food in Amman, Jordan. Saturated fatty acids (SFA) are higher in regular samples whereas MUFAs, PUFAs and TFA are higher in healthy than in regular samples. According to nutritional recommendations, omega-6/omega-3 and PUFA/SFA healthy samples show higher conformity. Moreover, AI/TI ratios are lower in healthy samples than regular ones. The results of this study show that the analyzed healthy samples in Amman city could be a good alternative for the regular fast-food. Thus, it is recommended to consume healthy fast foods with proper amounts and low frequency.

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Table 1: Saturated fatty acids content in selected Jordanian regular fast-food samples

SFA	C4:0	C6:0	C8:0	C10:0	C12:0	C14:0	C16:0	C17:0	C18:0	C20:0	Σ SFA
BB	$0.33^{de}\pm0.11$	$0.25^{ef}\pm0.12$	$0.29^{cde}\pm0.20$	$0.47^{ef}\pm0.21$	$0.63^{de}\pm0.23$	$3.16^{bc}\pm0.57$	$20.75^{bcd}\pm2.73$	$0.21^{abc}\pm0.08$	$11.57^{a}\pm3.45$	$0.34^{abc}\pm0.03$	$37.86^{cd}\pm7.34$
CB	$0.31^{de}\pm0.08$	$0.23^{ef}\pm0.08$	$0.25^{de}\pm0.10$	$0.35^{ef}\pm0.10$	$0.56^{de}\pm0.20$	$1.94^{bc}\pm0.49$	$29.68^{abc}\pm5.30$	$0.04^{de}\pm0.03$	$5.52^{cde}\pm0.67$	$0.18^{bc}\pm0.10$	$39.06^{cd}\pm6.81$
CF	$0.57^{cd}\pm0.25$	$0.43^{de}\pm0.21$	$0.40^{bcd}\pm0.29$	$0.75^{de}\pm0.43$	$1.54^{cd}\pm1.39$	$2.97^{bc}\pm1.54$	$17.31^{d}\pm5.81$	$0.07^{de}\pm0.05$	$5.20^{cde}\pm1.07$	$0.11^{c}\pm0.06$	$29.34^{d}\pm10.77$
FF	ND	ND	ND	ND	ND	$0.56^{c}\pm0.32$	$30.11^{abc}\pm13.28$	$0.12^{cde}\pm0.16$	$4.47^{e}\pm0.02$	$0.71^{a}\pm0.57$	$35.96^{cd}\pm14.00$
CS	$0.11^{e}\pm0.06$	$0.10^{f}\pm0.06$	$0.09^{e}\pm0.05$	$0.19^{ef}\pm0.11$	$0.41^{e}\pm0.24$	$5.76^{abc}\pm8.38$	$17.88^{cd}\pm10.26$	ND	$4.69^{de}\pm1.92$	$0.42^{abc}\pm0.44$	$28.97^{d}\pm4.61$
IP	$1.89^{a}\pm0.39$	$1.42^{a}\pm0.28$	$0.78^{b}\pm0.44$	$2.46^{ab}\pm0.56$	$3.28^{ab}\pm0.30$	$8.99^{a}\pm1.58$	$29.47^{abcd}\pm1.91$	$0.26^{abc}\pm0.06$	$8.78^{abc}\pm1.42$	$0.43^{abc}\pm0.11$	$57.75^{ab}\pm5.53$
EP	$2.27^{a}\pm0.14$	$1.72^{a}\pm0.12$	$1.18^{a}\pm0.16$	$2.78^{a}\pm0.52$	$3.39^{a}\pm0.58$	$10.83^{a}\pm2.13$	$30.85^{ab}\pm3.75$	$0.27^{ab}\pm0.11$	$9.72^{ab}\pm1.96$	$0.57^{ab}\pm0.18$	$63.58^{ab}\pm7.86$
CQ	$1.03^{bc}\pm0.5$	$0.73^{bcd}\pm0.36$	$0.63^{bc}\pm0.24$	$1.37^{cd}\pm0.56$	$1.75^{d}\pm0.72$	$5.72^{abc}\pm2.26$	$27.65^{bcd}\pm5.06$	$0.18^{bcd}\pm0.06$	$8.10^{abcd}\pm1.65$	$0.37^{abc}\pm0.09$	$47.52^{bc}\pm11.17$
BQ	$1.34^{b}\pm0.37$	$0.98^{bc}\pm0.30$	$0.66^{b}\pm0.16$	$1.46^{c}\pm0.45$	$1.79^{d}\pm0.54$	$6.36^{ab}\pm1.61$	$28.59^{abcd}\pm3.21$	$0.27^{ab}\pm0.08$	$10.81^{ab}\pm1.41$	$0.45^{abc}\pm0.06$	$52.71^{abc}\pm7.76$
BS	ND	ND	ND	$0.12^{ef}\pm0.11$	$0.18^{e}\pm0.15$	$1.84^{bc}\pm1.51$	$18.00^{cd}\pm3.99$	$0.24^{abc}\pm0.15$	$7.80^{bcde}\pm2.62$	$0.22^{bc}\pm0.13$	$28.30^{d}\pm8.37$
T	$0.79^{cd}\pm0.32$	$0.66^{cd}\pm0.26$	$0.54^{bcd}\pm0.15$	$1.39^{cd}\pm0.53$	$2.28^{bc}\pm0.96$	$7.26^{ab}\pm3.06$	$26.21^{a}\pm7.43$	$0.23^{abc}\pm0.08$	$8.53^{abc}\pm2.55$	$0.32^{abc}\pm0.10$	$48.21^{bc}\pm15.11$
H	$1.38^{b}\pm0.29$	$1.04^{b}\pm0.23$	$0.77^{b}\pm0.13$	$1.98^{bc}\pm0.21$	$2.65^{abc}\pm0.32$	$9.75^{a}\pm0.62$	$40.37^{a}\pm2.96$	$0.33^{a}\pm0.02$	$8.49^{abc}\pm1.68$	$0.24^{bc}\pm0.04$	$67.01^{a}\pm3.75$
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00

Values are means ±SME (Standard Mean of Error)

$^{a, b, c, d, e, f}$ Different letters within the same row indicate significantly ($p < 0.05$) different data

$\alpha=0.05$

SFA: Saturated fatty acids. SFA are expressed in (g/100g fat)

BB: Beef burger, CB: Chicken burger, CF: Chicken fajita, FF: French fries, CS: Chicken shawarma, IP: Chicken pizza, EP: Cheese pizza, CQ: Chicken quesadilla, BQ: Beef quesadilla, T: Turkey sandwich, H: Halloumi sandwich

ND: Not detected

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Table 2: Saturated fatty acids content in selected Jordanian healthy fast-food samples

SFA	C4:0	C6:0	C8:0	C10:0	C12:0	C14:0	C16:0	C17:0	C18:0	C20:0	Σ SFA
HBB	$0.55^{f}\pm0.01$	$0.40^{f}\pm0.01$	$0.28^{f}\pm0.01$	$0.79^{f}\pm0.02$	$0.98^{e}\pm0.02$	$3.73^{f}\pm0.09$	$18.86^{f}\pm0.46$	$0.22^{d}\pm0.00$	$9.92^{c}\pm0.24$	$0.23^{f}\pm0.00$	$35.97^{e}\pm0.88$
HCB	$0.47^{g}\pm0.01$	$0.34^{g}\pm0.01$	$0.24^{g}\pm0.00$	$0.63^{g}\pm0.01$	$0.82^{f}\pm0.02$	$2.80^{g}\pm0.07$	$17.13^{g}\pm0.42$	$0.08^{i}\pm0.00$	$4.96^{g}\pm0.12$	$0.13^{g}\pm0.00$	$27.61^{f}\pm0.67$
HCF	ND	ND	$0.29^{f}\pm0.01$	$0.25^{i}\pm0.01$	$0.10^{i}\pm0.00$	$0.39^{j}\pm0.01$	$19.57^{f}\pm0.48$	ND	$4.34^{h}\pm0.10$	ND	$24.94^{g}\pm0.61$
BP	ND	ND	ND	ND	ND	$0.34^{j}\pm0.01$	$15.73^{h}\pm0.38$	$0.13^{h}\pm0.00$	$4.12^{h}\pm0.10$	$0.27^{e}\pm0.01$	$20.60^{h}\pm0.50$
HCS	$0.31^{h}\pm0.01$	$0.25^{h}\pm0.01$	$0.21^{h}\pm0.00$	$0.52^{h}\pm0.01$	$0.66^{g}\pm0.02$	$2.31^{h}\pm0.06$	$16.97^{g}\pm0.41$	$0.08^{i}\pm0.00$	$5.08^{fg}\pm0.12$	$0.07^{h}\pm0.00$	$26.47^{fg}\pm0.64$
IPH	$1.70^{c}\pm0.04$	$1.14^{b}\pm0.03$	$0.69^{d}\pm0.01$	$1.63^{c}\pm0.04$	$1.95^{c}\pm0.05$	$7.18^{c}\pm0.17$	$24.51^{d}\pm0.60$	$0.26^{b}\pm0.01$	$8.87^{de}\pm0.22$	$0.45^{a}\pm0.01$	$48.40^{d}\pm1.18$
EPH	$2.50^{a}\pm0.06$	$1.84^{a}\pm0.04$	$1.19^{a}\pm0.02$	$2.72^{b}\pm0.07$	$3.02^{b}\pm0.07$	$9.51^{b}\pm0.23$	$28.25^{c}\pm0.69$	$0.18^{f}\pm0.00$	$9.01^{d}\pm0.22$	$0.41^{bc}\pm0.01$	$58.63^{b}\pm1.43$
HCQ	$0.62^{e}\pm0.01$	$0.51^{e}\pm0.01$	$0.48^{e}\pm0.01$	$1.21^{e}\pm0.03$	$1.54^{d}\pm0.04$	$5.31^{e}\pm0.13$	$31.09^{b}\pm0.76$	$0.14^{g}\pm0.00$	$8.63^{e}\pm0.21$	$0.40^{c}\pm0.01$	$49.93^{d}\pm1.22$
HBQ	$1.07^{d}\pm0.03$	$0.79^{d}\pm0.02$	$1.16^{b}\pm0.03$	$1.36^{d}\pm0.03$	$1.92^{c}\pm0.05$	$6.60^{d}\pm0.16$	$28.84^{c}\pm0.70$	$0.50^{a}\pm0.01$	$12.61^{a}\pm0.31$	$0.38^{d}\pm0.01$	$55.24^{c}\pm1.35$
HBS	$0.09^{i}\pm0.002$	$0.07^{i}\pm0.00$	$0.06^{j}\pm0.00$	$0.16^{j}\pm0.00$	$0.22^{h}\pm0.00$	$1.50^{i}\pm0.04$	$14.64^{i}\pm0.36$	$0.19^{e}\pm0.00$	$10.23^{c}\pm0.25$	$0.13^{g}\pm0.00$	$27.30^{f}\pm0.66$
HT	ND	ND	$0.11^{i}\pm0.00$	$0.06^{k}\pm0.00$	$0.11^{i}\pm0.00$	$0.51^{j}\pm0.01$	$22.10^{e}\pm0.54$	ND	$5.39^{f}\pm0.13$	ND	$28.28^{f}\pm0.69$
HH	$1.93^{b}\pm0.05$	$0.89^{c}\pm0.02$	$1.12^{c}\pm0.03$	$2.83^{a}\pm0.07$	$3.51^{a}\pm0.08$	$12.05^{a}\pm0.29$	$34.91^{a}\pm0.85$	$0.48^{b}\pm0.01$	$11.31^{b}\pm0.27$	$0.42^{b}\pm0.01$	$69.45^{a}\pm1.69$
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Values are means ±SME (Standard Mean of Error)

[a, b, c, d, e, f] Different letters within the same row indicate significantly ($p< 0.05$) different data

$\alpha=0.05$

SFA: Saturated fatty acids. SFA are expressed in (g/100g fat)

HBB: Healthy beef burger, HCB: Healthy chicken burger, HCF: Healthy chicken fajita, BP: Baked potato, HCS: Healthy chicken shawarma, IPH: Healthy chicken pizza, EPH: Healthy cheese pizza, HCQ: Healthy chicken quesadilla, HBQ: Healthy beef quesadilla, HT: Healthy turkey sandwich, HH: Healthy halloumi sandwich

ND: Not detected

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Table 3: Monounsaturated fatty acids content in selected Jordanian regular fast-food samples

MUFA	C16:1	C17:1	C18:1	ΣMUFA
BB	1.59^{b}±0.28	0.39^{ab}±0.05	35.01^{abc}±3.98	36.99^{abc}±3.65
CB	1.38^{b}±0.30	0.09^{cde}±0.05	36.66^{ab}±3.25	38.13^{ab}±3.09
CF	1.06^{ab}±0.32	0.12^{bcde}±0.02	41.64^{a}±10.45	42.82^{a}±10.12
FF	0.20^{a}±0.04	0.04^{de}±0.16	36.23^{ab}±5.07	36.46^{abc}±5.10
CS	2.11^{b}±1.54	ND	36.62^{ab}±10.62	38.73^{ab}±9.20
IP	1.71^{b}±0.48	0.30^{abcd}±0.06	26.02^{bc}±1.90	28.03^{bc}±2.30
EP	1.63^{b}±0.22	0.41^{a}±0.02	24.27^{c}±2.75	26.31^{c}±2.75
CQ	1.25^{ab}±0.24	0.24^{abcde}±0.11	32.87^{abc}±2.98	34.36^{abc}±2.68
BQ	1.65^{b}±0.34	0.41^{a}±0.07	32.93^{abc}±2.53	34.98^{abc}±2.75
BS	1.43^{b}±1.06	0.49^{abc}±0.47	41.13^{a}±4.42	42.88^{a}±5.92
T	1.41^{b}±0.40	0.29^{abcd}±0.10	32.94^{abc}±7.90	34.65^{abc}±7.60
H	2.11^{b}±0.13	0.45^{a}±0.02	27.13^{bc}±3.57	29.69^{bc}±3.55
P-value	0.07	0.00	0.02	0.02

Values are means ±SME (Standard Mean of Error)

$^{A, b, c, d, e, f}$ Different letters within the same row indicate significantly (p< 0.05) different data

α=0.05

MUFA: monounsaturated fatty acids. MUFA are expressed in (g/100g fat)

BB: Beef burger, CB: Chicken burger, CF: Chicken fajita, FF: French fries, CS: Chicken shawarma, IP: Chicken pizza, EP: Cheese pizza,

CQ: Chicken quesadilla, BQ: Beef quesadilla, T: Turkey sandwich, H: Halloumi sandwich

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Table 4: Monounsaturated fatty acids content in selected Jordanian healthy fast-food samples

MUFA	C16:1	C17:1	C18:1	Σ MUFA
HBB	1.43e±0.03	0.37c±0.01	46.25c±1.13	48.06c±1.17
HCB	1.44e±0.03	0.10h±0.00	51.22b±1.25	52.77b±1.29
HCF	2.10b±0.05	ND	53.23a±1.30	55.33a±1.35
BP	1.43e±0.03	0.06i±0.00	47.55c±1.16	49.04c±1.20
HCS	1.73c±0.04	0.11h±0.00	50.46b±1.23	52.31b±1.27
IPH	1.39e±0.03	0.36d±0.01	32.54e±0.79	34.29e±0.84
EPH	1.60d±0.04	0.34e±0.01	27.35f±0.67	29.29f±0.71
HCQ	1.15g±0.03	0.19g±0.00	33.16e±0.81	34.50e±0.84
HBQ	1.26f±0.03	0.47b±0.01	34.06e±0.83	35.78e±0.87
HBS	0.92h±0.02	0.28f±0.01	44.21d±1.08	45.41d±1.11
HT	2.45a±0.06	ND	33.67e±0.82	36.12e±0.88
HH	1.60d±0.04	0.65a±0.01	24.98g±0.61	27.24g±0.66
P-value	0.00	0.00	0.00	0.00

Values are means ±SME (Standard Mean of Error)
[A, b, c, d, e, f] Different letters within the same row indicate significantly ($p < 0.05$) different data
α=0.05
MUFA: monounsaturated fatty acids. MUFA are expressed in (g/100g fat)
HBB: Healthy beef burger, HCB: Healthy chicken burger, HCF: Healthy chicken fajita, BP: Baked potato, HCS: Healthy chicken shawarma, IPH: Healthy chicken pizza, EPH: Healthy cheese pizza, HCQ: Healthy chicken quesadilla, HBQ: Healthy beef quesadilla, HT: Healthy turkey sandwich, HH: Healthy halloumi sandwich

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Table 5: Polyunsaturated fatty acids content in selected Jordanian regular fast-food samples

PUFA	C18:2	C18:3	ΣPUFA
BB	24.36[ab]±2.81	2.77[bc]±1.10	27.13[abc]±3.90
CB	23.10[ab]±5.35	2.1[bc]±1.42	25.19[abc]±6.61
CF	25.80[ab]±2.98	4.3[ab]±2.17	30.09[abc]±2.82
FF	25.91[ab]±16.48	1.44[bc]±2.00	27.35[abc]±18.25
CS	28.10[a]±7.53	6.35[a]±3.75	34.45[a]±6.89
IP	14.41[abc]±6.84	1.68[bc]±0.65	16.09[bcd]±7.47
EP	10.44[bc]±7.30	1.54[bc]±1.01	11.98[cd]±8.31
CQ	18.65[abc]±8.67	1.53[c]±0.28	20.18[abcd]±8.92
BQ	13.04[abc]±7.05	1.27[bc]±0.55	14.31[bcd]±7.57
BS	28.38[a]±12.68	2.69[bc]±2.71	31.07[ab]±14.51
T	17.62[abc]±11.62	1.51[bc]±1.54	19.13[abcd]±11.70
H	4.59[c]±0.45	0.69[c]±0.07	5.29[d]±0.52
P-value	0.04	0.04	0.02

Values are means ±SME (Standard Mean of Error)
[a, b, c, d, e, f] Different letters within the same row indicate significantly ($p < 0.05$) different data.
$\alpha=0.05$
PUFA: polyunsaturated fatty acids. PUFA are expressed in (g/100g fat)
BB: Beef burger, CB: Chicken burger, CF: Chicken fajita, FF: French fries, CS: Chicken shawarma, IP: Chicken pizza, EP: Cheese pizza,
CQ: Chicken quesadilla, BQ: Beef quesadilla, T: Turkey sandwich, H: Halloumi sandwich

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Table 6: Polyunsaturated fatty acids content in selected Jordanian healthy fast-food samples

PUFA	C18:2	C18:3	Σ PUFA
HBB	14.60^{g}±0.36	3.49^{d}±0.08	18.09^{g}±0.44
HCB	17.97^{e}±0.44	3.93^{c}±0.09	21.90^{e}±0.53
HCF	20.14^{d}±0.49	1.92^{f}±0.05	22.06^{e}±0.54
BP	31.10^{b}±0.76	1.65^{g}±0.04	32.75^{b}±0.80
HCS	19.40^{d}±0.47	4.11^{b}±0.10	23.51^{d}±0.57
IPH	18.35^{e}±0.45	0.92^{i}±0.02	19.27^{f}±0.47
EPH	12.86^{h}±0.31	0.99^{i}±0.02	13.85^{h}±0.34
HCQ	16.28^{f}±0.40	1.18^{h}±0.03	17.46^{g}±0.42
HBQ	6.04^{i}±0.15	4.90^{a}±0.12	10.95^{i}±0.27
HBS	28.05^{c}±0.68	1.56^{g}±0.04	29.61^{c}±0.72
HT	35.13^{a}±0.86	2.88^{e}±0.07	38.01^{a}±0.93
HH	4.97^{j}±0.12	0.22^{j}±0.00	5.20^{j}±0.13
P-value	0.00	0.00	0.00

Values are means ±SME (Standard Mean of Error)
[a, b, c, d, e, f] Different letters within the same row indicate significantly ($p < 0.05$) different data.
α=0.05
PUFA: polyunsaturated fatty acids. PUFA are expressed in (g/100g fat)
HBB: Healthy beef burger, HCB: Healthy chicken burger, HCF: Healthy chicken fajita, BP: Baked potato, HCS: Healthy chicken shawarma, IPH:
Healthy chicken pizza, EPH: Healthy cheese pizza, HCQ: Healthy chicken quesadilla, HBQ: Healthy beef quesadilla, HT: Healthy turkey
sandwich, HH: Healthy halloumi sandwich

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Table 7: Health indices in selected Jordanian regular fast-food samples

Indices	ω-6/ω-3	IA	IT	PUFA/SFA
BB	9.42^{a}±2.40	0.72^{c}±0.20	0.94^{cde}±0.30	0.75^{abcd}±0.27
CB	13.23^{a}±4.94	0.69^{c}±0.18	1.05^{cde}±0.33	0.68^{abcd}±0.30
CF	7.95^{a}±5.98	0.5^{c}±0.26	0.59^{e}±0.34	1.13^{ab}±0.48
FF	56.59^{b}±66.07	0.62^{c}±0.34	1.13^{cde}±0.66	1.04^{abc}±1.09
CS	5.77^{a}±4.19	0.62^{c}±0.29	0.54^{e}±0.04	1.20^{a}±0.25
IP	8.35^{a}±1.57	1.72^{ab}±0.42	1.84^{bc}±0.47	0.29^{bcd}±0.16
EP	6.70^{a}±1.24	2.29^{a}±0.74	2.37^{ab}±0.82	0.20^{cd}±0.17
CQ	11.81^{a}±3.74	1.14^{bc}±0.49	1.40^{bcde}±0.53	0.48^{abcd}±0.33
BQ	9.89^{a}±2.98	1.37^{bc}±0.48	1.71^{bcd}±0.57	0.29^{bcd}±0.17
BS	17.05^{a}±9.73	0.47^{c}±0.24	0.68^{de}±0.36	1.25^{a}±0.75
T	22.30^{ab}±26.76	1.36^{bc}±0.94	1.60^{bcde}±1.08	0.46^{abcd}±0.32
H	6.65^{a}±0.20	2.54^{a}±0.50	3.06^{a}±0.50	0.08^{d}±0.01
P-value	0.26	0.00	0.00	0.03

Values are means ±SME (Standard Mean of Error)
$^{a, b, c, d, e}$ Different letters within the same row are significantly ($p < 0.05$) different
α=0.05
ω-6/ω-3: Omega-6 to omega-3 ratio, IA: Atherogenic index, IT: Thrombogenic index, PUFA/SFA: Polyunsaturated to saturated fatty acids ratio
BB: Beef burger, CB: Chicken burger, CF: Chicken fajita, FF: French fries, CS: Chicken shawarma, IP: Chicken pizza, EP: Cheese pizza,
CQ: Chicken quesadilla, BQ: Beef quesadilla, T: Turkey sandwich, H: Halloumi sandwich

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Table 8: Health indices in selected Jordanian healthy fast-food samples

Indices	ω-6/ω-3	IA	IT	PUFA/SFA
HBB	4.18^{k}±0.00	0.66^{f}±0.00	0.77^{f}±0.00	0.50^{g}±0.00
HCB	4.58^{j}±0.00	0.45^{g}±0.00	0.52^{j}±0.00	0.79^{f}±0.00
HCF	10.47^{h}±0.00	0.33^{k}±0.00	0.56^{i}±0.00	0.88^{e}±0.00
BP	18.87^{c}±0.00	0.26^{l}±0.00	0.45^{l}±0.00	1.59^{a}±0.00
HCS	4.72^{i}±0.00	0.41^{h}±0.00	0.50^{k}±0.00	0.89^{d}±0.00
IPH	19.88^{b}±0.00	1.16^{e}±0.00	1.39^{d}±0.00	0.40^{h}±0.00
EPH	12.96^{f}±0.00	1.74^{b}±0.00	1.94^{b}±0.00	0.24^{j}±0.00
HCQ	13.79^{e}±0.00	1.17^{d}±0.00	1.55^{c}±0.00	0.35^{i}±0.00
HBQ	1.23^{l}±0.00	1.45^{c}±0.00	1.32^{e}±0.00	0.20^{k}±0.00
HBS	17.95^{d}±0.00	0.41^{i}±0.00	0.63^{g}±0.00	1.08^{c}±0.00
HT	12.18^{g}±0.00	0.40^{j}±0.00	0.63^{h}±0.00	1.34^{b}±0.00
HH	22.15^{a}±0.00	2.91^{a}±0.00	3.46^{a}±0.00	0.07^{l}±0.00
P-value	0.00	0.00	0.00	0.00

Values are means ±SME (Standard Mean of Error)

$^{a, b, c, d, e}$ Different letters within the same row are significantly ($p < 0.05$) different

α=0.05

ω-6/ω-3: omega-6 to omega-3 ratio, IA: atherogenic index, IT: thrombogenic index, PUFA/SFA: polyunsaturated to saturated fatty acids ratio

HBB: Healthy beef burger, HCB: Healthy chicken burger, HCF: Healthy chicken fajita, BP: Baked potato, HCS: Healthy chicken shawarma, IPH: Healthy chicken pizza, EPH: Healthy cheese pizza, HCQ: Healthy chicken quesadilla, HBQ: Healthy beef quesadilla, HT: Healthy turkey sandwich, HH: Healthy halloumi sandwich

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