

Chemical and Sensory investigations of Some commercial and Home-made products**Taghreed M. Galal¹, Seham A. Farrag¹, Rofida F. Moftah^{2*}**¹Home Economics Department, Faculty of Specific Education, Assiut University, Assiut Egypt.²Food Science and Technology Department, Faculty of Agriculture, Assiut University, Assiut Egypt.**Abstract**

The food we eat is one of the most important issues in modern society, and it is attracting increasing the attention of public agencies. When fast food is ingested frequently, the excess fat, simple carbohydrates, and processed sugar contained in junk food raise the risk of obesity, cardiovascular disease, and many other chronic health disorders. In addition to high prices for fast foods. Overall, our findings suggest that increases in the supply of fast food restaurants have a significant effect harmful. Therefore, in this study, we have produced home-made types of fast food, such as (Chicken burger sandwich, Beef burger sandwich, French fries, KFC and KZB sandwich). In this investigation, we performed chemical composition, fatty acid analysis, and sensory evaluation of both homemade and restaurant made sandwiches. It was noted that there is an increase in the content of protein, carbohydrates, fiber, and moisture. Moreover, there are a decrease in the content of fat and ash, the amount of calories as well as a decrease in the percentage of saturated fatty acids, in sandwiches prepared at home when compared to the ones prepared in the restaurant. Furthermore, it was found that it was an increase in the consumer's accepts in general than the products prepared in restaurants.

Keywords: Fast food, Chemical composition, sensory evaluation.

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Introduction

Fast food is food sold in a restaurant or store that is fast made and served in a packaged container for delivery such as Burgers, pizzas, fries, hamburgers, patties, nuggets. Kaushik et al., 2011, there are many factors related to fast food consumption, the first is working the parents for a long time and they haven't time for meal preparation at home. While, second factor is most children spend a lot of their time away from home, either attending school classes or enjoying in free time so that fast food become handy for them (Niemeier et al., 2006). There are various risks to consumption of fast food such as heart diseases and obesity. Fast food has an energy density that is more than twice that of the daily allowance for youngsters (Printice et al., 2003), because fast foods have high level of fat and sugars (Asgary et al., 2009). Additionally, fast food has a low nutritive value (carotene, vitamin A and vitamin C) (Bowman et al., 2004). So, we should make efforts to stop the fast food Phenomenon such as improve the children's nutritional habits by presenting nutrition education programs (French et al., 2003). One of the most effective ways for increasing healthy food buying among consumers is decrease of value of price of healthy food (Gortmake et al., 1999). Encourage the make of products similar to those in restaurants like beef burger, chicken burger, fried chicken, fried fries in home and more nutrition value. Meat and meat products are one of the most important sources of protein in people's daily meal in developed countries. Beef burger is one of the most favorite meat products consumed by many people in all world (Ladiko et al., 1999). The processing technology of meat gave high nutritional value product high in protein and low in fat makes preparing food easier and quick state by little cost (Elkreney, 2000). Chicken meat is the most preferred animal protein source due to the lack of cultural or religious limits on poultry consumption (Van der Sluis, 2001 and

Barbut, 2002). Chicken breast is one of the most preferred slices of chicken because of its high protein content, low fat content (which is less saturated than beef fat) and nil carbohydrate content, making it an ideal choice for persons trying to lose weight or suffering from diseases like cardiovascular diseases. Chicken protein is a rich source of all the essential amino acids. So that Chicken meat was used in making many of chicken products in home provide high nutrition and low cost of these products, chicken burger, Kentucky Fried Chicken (KFC), Kentucky Zinger Burger Sandwich (KZB).

The objectives of this study were

1. Determination of the gross chemical composition of beef, chicken, fries products processed in home compare with three commercial products.
2. Evaluation of fatty acid composition of beef burger, chicken, fries products processed in home compare with three commercial products.

Materials and methods

Materials:

Chicken, beef, cheese, onions, garlic, lettuce, tomatoes, cucumbers, potatoes, flour, rusk, bread, sunflower oil, soy oil, eggs, soybeans, starch, sugar, vinegar salt, black pepper, mustard seeds, garlic powder, onion powder, turmeric, cumin, dried coriander, ground cloves, Cardamom, ginger powder, paprika and mace, Mustard, barbecue all these materials were purchased from the local market of Assiut city, Egypt. All reagents and chemicals used in this study were obtained from EL-Gamhouria for Trading Chemicals and Drugs Co., Assiut city, Egypt.

Methods:

Technological Methods

Preparation of Beef

Frozen meat was thawed at room temperature ($22\pm 3^{\circ}\text{C}$) for 4-5 hr. dressed by removing their surrounded fat layers, Part

of it was cut to a thickness of 10 cm to make shawarma, and the other part was minced through 5mm plate of Luska meat chopper to make a burger (Nadia et al., 2018).

Preparation of chicken

Chicken pieces were prepared with the bones from the chest, hip and wing. All subcutaneous/trimmable fat, external fascia and all adhering connective tissues were removed from the muscles and the skin was not removed from them. Then it was washed well to make KFC (Deepthi et al., 2011). Chicken breast, boneless, skinless to make KZB (Rashmi et al., 2011), and other pieces were minced to make burger (Khallaf et al., 2014).

Preparation of products

Preparation of Homemade (HM) French fries

French fries were prepared as followed by (Moftah et al., 2013) with modification in materials and method, The potato tubers were washed, hand-peeled using stainless steel knives to remove a thin outer layer of peel and then sliced using a mandolin slicer (Master chef, GOURMET, chine model) to a thickness of 1.5 cm and 7 cm in length. The potato slices were thoroughly washed and drained. Then the following steps were taken.

1-Soaking the potatoes in the solution consisting components (2 liters water, 5g vinegar, 15 g salt, 15g honey and 30 g sugar) for two hours. Then rinsed from the solution with water and dried.

2-Fry at 180°C for 3 minutes, then put in the freezer at- 20°C for an hour and fry again until desired golden colour was reached.

Preparation of Homemade (HM) Chicken Burger Sandwich

Chicken Burger was prepared as method followed by (Khallaf et al., 2014) Chicken, onion, salt, pepper, Egg, bread, lettuce, tomatoes, Cucumber, sunflower oil and mayonnaise were bought from local market. Preparation of chicken burger fresh chicken burger samples were prepared as follows, all ingredients (88g Minced chicken meet, 10g Fresh onion, 1g salt, 0.5g

Black pepper and 1g spices mixture) were minced twice, and chicken mixture the ingredients mixed using mincer was shaped manually using patty maker to obtain round disks 10cm diameter and 0.5 cm thickness. Burgers were packed in polyethylene bags and put in the freezer at- 20°C for an hour. Then put the slice in the eggs (40gm), then the rusk (30gm), then fry in the oil, and the sandwich is stacked with a layer of bread (40gm), and add mayonnaise (10gm), the lettuce (40gm), the burger slice (100gm), a slice of burger cheese (20gm), sliced tomatoes (40gm), mayonnaise (10gm), another slice of bread (40gm) respectively.

Preparation of Homemade (HM) Beef Burger Sandwich

Beef Burger was prepared as method followed by (Nadia et al., 2018) Frozen meat was thawed at room temperature (22±3°C) for 4-5 hr., then removing their surrounded fat layers, cut into 10 cm thickness and minced 2 times through 5mm plate of Luska meat chopper, It was mixed with all ingredients (74g minced meat, 4g fresh onions, 20g soybean, 1g salt and 1g spices mixture) then formed into around pieces with 10 cm diameter, 1cm thickness and 100g weight, and Cooking it on a grill at 140°C until Ripen, and the sandwich is stacked with a layer of bread (40gm), then add Burger Sauce (10gm), the lettuce (40gm), the burger slice (100gm), a slice of burger cheese (20gm), sliced tomatoes (40gm), Burger Sauce (10gm), Sliced pickled cucumber (20gm), another slice of bread (40gm) respectively.

Preparation of Homemade (HM) Kentucky Fried Chicken (KFC)

Kentucky Fried Chicken was prepared as followed by (Deepthi et al., 2011) with modification in materials and method. Chicken pieces were prepared from the chest, hip and wing without removing the skin and bones. It was washed well and then soaked for 24 hours in a soaking solution consisting of a liter of water and spices (black pepper, cumin, dried coriander, paprika, onion powder,

curry, turmeric, Crushed cardamom, sugar, nutmeg) In addition to, salt and Yogurt (300g Chicken, 100g Yogurt, 3g salt and 3g spices). 125 grams of flour are placed with them 15 grams of starch. Dip the chicken in flour, then in ice water 10 seconds, then in flour and spread out on a large tray and then put in the freezer at- 20°C for an hour. In a deep bowl, we put abundant oil, it is better to cover the pan or bowl during frying after the cooking.

Preparation of Homemade (HM) Kentucky Zinger Burger Sandwich (KZB)

Kentucky Zinger Burger was prepared as followed by (Rashmi et al., 2011) with modification in materials and method. Slices of chicken breast without skin and bones. It was washed well and then soaked for 24 hours in a soaking solution consisting of a liter of water and spices (black pepper, cumin, dried coriander, paprika, onion powder, tomato powder, curry, turmeric, Crushed cardamom, sugar, and nutmeg) in addition of salt and yogurt (100g Chicken, 50g Yogurt, 1.5g salt and 1.5g spices) 125 grams of flour are placed with them 15 grams of starch. Dip the chicken in flour, then in ice water 10 seconds, then in flour and spread out on a large tray and then put in the freezer at- 20°C for an hour. In a deep bowl, put abundant oil, it is better to cover the pan or bowl during frying after the cooking.

The sandwich is stacked with a layer of bread (40gm), and add mayonnaise (10gm), the lettuce (40gm), the chicken slice (100gm), sliced tomatoes (40gm), mayonnaise (10gm), another slice of bread (40gm) respectively.

Analytical methods:

Chemical composition

Moisture, crude protein, ash and crude fat contents were determined according to official methods (AOAC, 2010) in Agricultural Research Center, Cairo Egypt, the results were an average of three replicates. Carbohydrate contents

were calculated by difference according to (Turhan et al., 2005) as follows.

$$\% \text{ Carbohydrate on dry weight} = 100 - (\% \text{ moisture} + \% \text{ protein} + \% \text{ fat} + \% \text{ ash})$$

Caloric value (kcal/100g).

Caloric value was calculated as described by Mohamed (2005)

$$\text{Caloric value (kcal/100 gm)} = (\% \text{ carbohydrate} \times 4) + (\% \text{ protein} \times 4) + (\% \text{ fat} \times 9).$$

Fatty acid composition

Fatty acid and sterol analysis Fatty acids were analyzed by gas liquid chromatography (GLC) as their methyl esters as per the International Union of Pure and Applied Chemistry (IUPAC, 1992).

Sensory evaluation of studied products

50 persons (specialists of nutrition and food science, and ordinary consumers) by hedonic scale ranging from 1 to 10 (1 is very bad and 10 for excellent) was used for sensory evaluation. The products were placed in white dishes under strong white lighting during evaluation. water was provided to rinse the palate between two tasting sessions (Larmond, 1997).

Statistical analysis

Data entry and analysis will be carried out using SPSS version 26. Differences between the two groups will be assess using Independent-Samples T Test when this difference is significant if P value less than 0.05 (SPSS, 2011).

The cost of commercial made (CM) and Homemade (HM) products

The cost of CM and HM product sandwiches (Chicken Burger, Beef Burger, French fries, KFC, KZB) Were approximately calculated. The price of HM sandwiches was lower than those of CM sandwiches. The price of 100g from CM Chicken burger sandwich was 22.85 L. E, while 100g HM Chicken burger sandwich was 5.00 L.E. The price of 100g CM Beef Burger sandwich was 19.00 L. E, while 100g HM Beef Burger sandwich was 4.00 L.E. The price of 100g CM French fries was 10.00 L. E, while 100g HM French fries were 3.00 pounds. The price of 100g CM

KFC was 20.00 L. E, while 100g HM KFC was 6.00 L.E. The price of 100g CM KZB sandwich was 24.00 L. E, while 100g HM KZB sandwich was 5.00 L.E. The whole results recommended that the HM products were cheaper than CM products Regarding of economic cost and highly nutrition.

Results and discussion

Chemical composition of products (CM) and (HM)

Moisture

The moisture of Chicken burger sandwich (CM), Chicken burger sandwich (HM), Beef burger sandwich (CM), Beef burger (HM), French fries (CM) ,French fries (HM), KFC (CM), KFC (HM), KZB sandwich (CM) and KZB sandwich (HM) were 50.81%, 49.34%, 54.48%,46.49%, 40.35%, 28.96%, 43.58, 55.33, 63.35 and 48.87 respectively. There were highly significant differences ($P \leq 0.01$) in moisture among all types of samples of commercial store and their Analogs in home except KFC (HM). The moisture content of commercial sandwiches was higher than in homemade one. These findings are consistent with (Huda et al., 2009 and Karema et al., 2011). Osakue et al., 2016 noted that the laboratory prepared food had the least moisture content, because the good frying reduces the moisture content in food (Varela et al., 2001). When the food fry in the hot frying oil that leads to the water content in the food replaced by oil, so the moisture content was decreased and the food became more appetizing. Moreover, the cafes and street vendors' meat had higher moisture content, since commercial producers do not need frying their meat product to the point where output is reduced in size and weight; more moisture in the flesh means more weight. and it becomes dry; However, in order to enhance yield, I would want the increased moisture level of fried chicken sold in restaurants was most likely related to this as well. warming the meat in the microwave before serving.

Ash

Table (1): showed that the ash contents of Chicken burger sandwich (CM), Chicken burger sandwich (HM), Beef burger sandwich (CM), Beef burger (HM), French fries (CM) ,French fries (HM), were 2.71%, 1.81%, 2.28%,1.75% , 1.65% and 1.24% respectively. All types of commercial store samples and their home analogues had highly significant variations in ash expect the products of KFC there was not significant differences in ash. The findings were agreed with that obtained by Karema et al., 2011 whom figured out that the ash of burger ranged from (2.72% – 3.61%). Moreover, the percentage of ash in KFC (CM), KFC (HM), KZB (CM), and KZB (HM) were 1.96%, 1.74%, 1.37% and 1.38% respectively. These results agree with El-Anany et al., 2020 observed that Ash content of formulated chicken nuggets ranged from 1.68% to 2.17%.

Lipid

Consumers' impression of meat products as good providers of nutrients is increasingly losing way to a more negative attitude, with consumers viewing them as unhealthy due to the addition of unhealthy elements in their composition such as high fat and cholesterol contents (Weiss et al., 2010, Grasso et al., 2014, Lorenzo et al., 2016 and Da Silva et al., 2019). There were highly significant differences ($P \leq 0.01$) in fat among all types of samples of commercial store and their Analogs in home Table (1). The higher fat was observed in commercial sandwiches products, while the lower fat was found in homemade sandwiches products. Karema et al., (2011) who were pointed-out that, beef burger fat was 7.33% – 20.20%, Teye et al., (2012) 4.80% – 6.73%, and Abdul Salam et al., (1995) 14.90% – 28.70%. The fat content of KFC (CM), KFC (HM), KZB sandwich (CM) and KZB sandwich (HM) were 25.42%, 24.03, 17.32%, 15.36% respectively. The high fat content (value) of KFC could be due to fat absorption during oil frying (Gilbert et al., 2000) or, as most

commercial vendors do, refrying of leftovers meat for the next day's sales, which concurs with the findings according

to Gill and Newton., 1997 the polarity of the oil changes after repeated frying.

Table (1) Gross chemical composition of products (CM)¹ and (HM)² on (D.W)³ and (W.W)⁴ basis (%) g/100g

Sample (%)	Moisture	Ash	Crude fat		Crude protein		Crude fiber		Carbohydrates		Energy (K/cal)
			D.W	W. W	D.W	W. W	D.W	W. W	D.W	W. W	
Chicken Burger sandwich (CM)	50.81**	2.71**	26.60**	13.085	18.89**	9.292	2.1	1.033	50.7**	24.94	254.693**
	49.34**	1.81**	15.50**	7.852	23.94**	12.128	2.3	1.165	56.45**	28.598	233.572**
Chicken burger sandwich (HM)	54.48**	2.28**	30.28**	13.783	30.97**	14.098	2.4**	1.092	34.07**	15.509	242.475**
Beef burger sandwich (CM)	46.49**	1.75**	11.55**	6.180	31.26**	16.727	2.7**	1.44	52.74**	28.22	235.408**
Beef burger sandwich (HM)	40.35**	1.65**	22.87**	13.642	4.99**	2.977	3**	1.79	67.49**	40.258	344.721**
French fries (CM)	28.96**	1.24**	20.44**	14.521	7.44**	5.286	3**	2.13	67.88**	48.222	295.718**
French fries (HM)	43.58**	1.96*	25.42**	14.342	25.69**	14.494	0.8*	0.451	46.13**	26.027	291.162**
KFC (CM)	55.33**	1.74*	24.03**	10.734	30.53**	13.638	1.1**	0.491	42.6*	19.029	227.274**
KFC (HM)	63.35**	1.37**	17.32**	6.348	18.67**	6.843	1.2	0.44	61.44**	22.518	237.976**
KZB sandwich (CM)	48.87**	1.38**	15.63**	7.992	25.22**	12.895	1.8	0.920	55.97**	28.617	174.576**
KZB sandwich (HM)											

commercial made (CM)

Homemade (HM) Dry weight (DW)

wet weight (WW)

*Significant at p< 0.05

**Highly significant at p< 0.01

Protein

The protein contents of home-made products were significantly higher than all types of samples of commercial store Table (1). This with agreement of Abdul Salam et al., 1995 and Teye et al., 2012. The difference in protein composition may be attributed to the meat sources (Paulina and Hammed, 2018). Moreover, Musa et al.,

2019 explain that clearly, these disparities can be traced back to the amount of meat utilized in the local burger, which was 65 percent another explanation is because the grade of the Commercial burgers may have less meat compared to ours.

Carbohydrates

In this study, total carbohydrate of samples was determined as the difference

between the amount of carbohydrate and the total quantity of all other constituents calculated. As shown in Table (1) the carbohydrates amount of products of homemade sandwiches were higher than the products of commercial sandwiches. There were highly significant differences ($P \leq 0.01$) in carbohydrate among all types of samples of commercial store and their Analogs in home. According to El-Anany et al., 2020 carbohydrate content of nugget samples varied from 4.62% to 9.43%, while Babji et al. (2000), chicken burgers had 2-

Total energy content

The total energy of the chicken burger samples was estimated and displayed as kilocalories (kcal) per 100 g edible portion. The result showed energy content of products of a homemade sandwich lower than the products of commercial sandwiches foods with highly

13% of carbohydrate. Moreover, the carbohydrate amount of Kuwait chicken burgers was 3-25% (Al-Bahouh et al., 2012). The carbohydrate content of the samples in this analysis was substantially greater than the levels reported by others due to use the bread with the sample. The majority of carbohydrates in all sample come from the usage of grains as components. Maize, tapioca, rice, potato, and wheat starches have been employed as meat filler and water binder in processed meat products (Joly and Anderstein, 2009).

significant difference Table (1). These findings attributed to the fact that one gram of lipids provides 9 kcal, while one gram of protein or carbohydrates provides 4 kcal (El-Anany et al., 2020). The same result obtained by Unzil et al., 2021, the caloric composition of the chicken burger samples ranged from 296.13 to 358.8 kcal.

Fatty acid composition

Table (2) Analysis of saturated fatty acids composition of products (CM) and (HM) on basis (% g/100

Fatty acids	Chicken burger sandwich (CM)	Chicken burger sandwich (HM)	Beef burger sandwich (CM)	Beef burger sandwich (HM)	French fries (CM)	French fries (HM)	KFC (CM)	KFC (HM)	KZB sandwich (CM)	KZB sandwich (HM)
Oxononahexacontanoic acid	0.046%	0.043%	-	-	-	-	-	-	-	-
Hexadecanoic acid	1.160%	0.493%	0.472%	0.532%	-	-	-	-	-	-
Hexadecanoic acid, 2-hydroxy-,methyl ester	-	-	2.628%	1.726%	2.401%	2.121%	6.303%	4.326%	8.282%	3.004%
Palmitic Acid	-	-	-	-	-	-	-	-	3.322%	2.120%
Octadecanoic acid	-	-	-	-	-	-	18.425%	9.342%	-	-

commercial made (CM) Homemade (HM)

Saturated fatty acids raise low-density lipoprotein (LDL) cholesterol levels, which has a negative impact on blood lipids (Mensink and Katan, 1992). Short-chain fatty acids (less than 10 carbon atoms) are thought to have a lower impact on serum cholesterol levels, but longer-chain fatty acids (12, 14, or 16 carbon atoms) are thought to raise LDL levels (Chait et al., 1993). Stearic acid (18 carbon atoms) is an

exception, as it does not appear to affect serum cholesterol levels (Hu et al., 2001). Increased saturated fatty acid consumption has also been linked to an increased risk of coronary heart disease (Kagan et al., 1974; Kushi et al., 1985; Kris-Etherton, 1999). Table 2 show the percentage of some saturated fatty acids (SFA) in both commercial and homemade products. There were highly significant differences in

saturated fatty acids composition among all types of samples of commercial store and their Analogs in home, this result was agreement with the finding mentioned by (Paul, B. C, 2019). The main cause for its difference, because the commercial one contains more animal fats which, contain a high percentage of saturated fatty acid (Ledoux et al., 2005 and Lopes et al., 2019).

Sensory evaluation of studied products

The mean sensory scores for the various products are reported in Table 3. A 9-hedonic scale test was used which ranged from 9 to 1, where 9, 8, 7, 6, 5, 4, 3, 2 and 1 means: like extremely, like very much, like moderately, like slightly, neither like nor dislike, dislike slightly, dislike moderately, dislike very much and dislike extremely, respectively.

The sensory acceptance test was carried out by 50 untrained consumers, including undergraduate students, postgraduate students, and staff of Assiut University, who represented a target audience that consumes fast food at least once a week. The sensory evaluation tests were carried out in order to determine the overall acceptability of the Chicken burger sandwich, Beef burger sandwich, French fries, KFC and KZB sandwich from commercial store and their analogues in the home. There were highly significant differences ($P \leq 0.01$) in ALL Sensory evaluation traits among all types of samples of commercial store and their Analogs in home. Reduced fat content in homemade products can improve a product's acceptability while also increasing the hardness of the meat (Giese, 1996). It is so important that various research have tried to preserve sensory and texture qualities by using fat substitutes (Jimenez, 1996).

Table (3) Statistical analysis of sensory evaluation of products (CM) and (HM)

Sample	Beef burger sandwich		French Fries		Chicken burger sandwich		KFC sandwich		KZB sandwich	
	CM	HM	CM	HM	CM	HM	CM	HM	CM	HM
Appearance	9.16**	9.86**	8.26**	9.4**	8.8**	9.73**	9**	9.16**	9.2**	9.97**
Taste	8.7**	9.66**	8.26**	9.53**	8.46**	9.46**	8.83**	9.16**	9.2**	10**
Chewing	8.56**	9.13**	8.3**	9.66**	8.13**	8.13**	8.93**	9.13**	8.86**	10**
Flavor	8.5**	9.73**	8.43**	9.6**	-	-	-	-	-	-

Crispy	-	-	-	-	8.2**	9.46**	8.9**	9.1**	8.5**	9.7**
order	8.83**	9.6**	8.3**	9.6**	8.43**	8.43**	8.73**	9.33**	9.3**	10**
Texture	8.63**	9.66**	8.7**	9.46**	8.33**	9.66**	8.66**	9.33**	9.26**	10**
Colour	8.66**	9.8**	8.7**	9.6**	8.86**	9.46**	9**	9.53**	9.13**	9.97**
Overall acceptability	8.53**	9.53**	8.4**	9.66**	8.36**	9.66**	8.96**	9.07**	9.06**	10**

commercial made (CM) Homemade (HM)

Conclusion

The whole results recommended that homemade sandwiches were not only cheaper than commercial made sandwiches regarding of economic cost but also, highly nutrient and lower in saturated fatty acids which concerned by heart diseases and obese people.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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