Research Article

Quality Characteristics of Beef Burger Formulated with Olive and Rice Bran Oils

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Abstract | The present work was conducted to investigate the quality aspects of Egyptian beef burgers and study the effect of replacing beef fat with vegetable oils (olive oil and rice bran oil) on their quality. Twenty beef burger samples were collected from Qena markets, Egypt. They were divided into four groups based on their price; A, B, C, and D, with group A being the cheapest while the group D being the most costly. Proximate and quality analysis were conducted. Group D of Egyptian beef burger had a greater protein than other groups as well as being the best in terms of quality. Furthermore, six beef burger formulations with different amounts of beef fat and vegetable oils were prepared and stored at 4 ± 1°C for 21 days. Analysis of samples showed that fat content was significantly lowered in F1 and F2 (beef fat partially replaced by olive and rice bran oils, respectively) than in control (100% beef fat). In addition to, aerobic plate count (APC), thiobarbituric acid reactive substances (TBARS) and total volatile basic nitrogen (TVB-N) for F1 and F2 groups were significantly lesser than the control group. F1 and F2 had significantly lower cooking loss than the control group. Furthermore, formulated samples had decreased level of the cholesterol, triglycerides and LDL (low-density lipoprotein) concentrations with greater level of HDL (high-density lipoprotein) concentrations. In conclusion, this study depicts for the quality status of the commercial beef burger in Egypt as well as the utilization of olive and rice bran oils as beef fat substitutes represents a promising technology for producing healthier burgers with enhanced quality characteristics.

Keywords | Beef burger, Olive oil, Rice bran oil, Fat replacer, Natural antioxidant

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INTRODUCTION

Meat is a crucial food because it contains high quality proteins, necessary fatty acids, vitamins and minerals. It also contributes to the enhancement of human health. The production and consumption of processed meat products has expanded substantially over the world because their excellent nutritional content and convenience.

Meat and meat products are very susceptible to quality deterioration, chemical and microbial changes (Devatkal et al., 2012) leading to undesirable odors and tastes as well as nutrient loss. The most common type of chemical deterioration is the oxidation of meat lipids as well as the protein, which results in a reduction in shelf life and formation of hazardous chemicals in meat. Synthetic antioxidants includes butylated hydroxyl anisole, tert-butylhydroquinone and propyl gallate can be added in processed meat (Papuc et al., 2017). On the other hand, synthetic antioxidants pose a health risk and toxicity. Hence, green-labeled foods, such as those containing natural antioxidants sourced from natural sources, are becoming increasingly popular. Therefore, the utilization of natural antioxidants sourced from essential herbal oils and extracts is gaining great interest.

Low-fat processed meat processing has gotten a lot of attention for better health all around the world. Vegetable oils have attracted the greatest interest, owing to their high content of monounsaturated fatty acids and antioxidant compounds. Among vegetable oils, olive and rice bran oils. Olive oil is rich in monounsaturated fatty acids, cholesterol-free and has a higher ratio of unsaturated to saturated fatty acids (Jiménez-Colmenero, 2007). Rice bran oil is a type of edible oils that includes the phytochemical oryzanol, tocopherols, and tocotrienols, which improve oxidative stability and durability when compared to other edible oils. It strengthens the immune system, fights cancer, and enhances the brain and endocrine systems (Nayik et al., 2015). Furthermore, rice bran oil lowers triglycerides and increases the good cholesterol to bad cholesterol ratio (HDL/ LDL), all of them are required for a good health.

Beef burgers are a popular meat products consumed by millions of people throughout the world because they provide quickly, easy-to prepare meat meals and alleviate the problem of fresh meat scarcity. Total or partial replacement of burger fat with olive and rice bran oils may enhance beef burger oxidative stability and nutritional value. Therefore, the goal of the current work is to determine the nutritional value and quality of commercially Egyptian beef burgers. In addition, the effect of replacing beef fat with olive and rice bran oils on the nutritional content and quality of beef burgers is being investigated.

MATERIAL AND METHODS

Part I: Evaluation of the quality and nutritive value of the commercial Egyptian beef burger.

Sample collection

From May to August 2019, twenty random burger samples of different four commercial companies (5 samples for each) were collected from local markets in Qena province, Egypt. They were classified into four groups (A, B, C, and D) based on their prices, where group A was the lowest price and group D was the highest one. All samples were held in an ice tank and transported to the laboratory, food hygiene department, Faculty of Veterinary Medicine, South Valley University.

Preparation of samples

Samples were prepared and examined according to the technique recommended by AOAC (2003). Twenty five gram of each sample was ground using stomacher and stored at – 20°C until analysis.

Proximate analysis of beef burger samples

Samples were analyzed in triplicates and the methods adopted were as the following:

- Determination of crude protein by biuret method (Torten and Whitaker, 1964).
- Determination of moisture, fat and ash contents (AOAC, 2000).
- Estimation of total carbohydrate content (AOAC, 2003).
- Calculation of energy value (Merrill and Watt, 1973).

Assessment of quality aspects of the marketed frozen beef burgers

- Determination of pH value (Olatidoye et al., 2015).
- Determination of APC. It was conducted on the same day as the sampling (APHA, 2001).
- Determination of TVB-N (ES 63/9, 2006).
- Determination of TBARS (ES 63/10, 2006).

Part II: Studying the effect of substituting animal fat with olive and rice bran oils on the nutritive value and the quality of beef burger.

Preparation of beef burger samples

Fresh beef meat and beef fat were purchased from a local markets in Qena and transferred to the Lab. Both beef meat and beef fat were minced separately, then six beef burger formulations were prepared (Table 1). All formulations were stored at 4 ± 1°C for 21 days. Samples (days 0, 7, 14, 21) were collected and investigated for proximate analysis as explained before, as well as the following analysis was conducted.

Assessment of quality aspects of the formulated beef burgers

- Sensory evaluation (Ambrosiadis et al., 2004).
- Cooking loss (Murphy et al., 1975).
- Determination of pH, TVB-N and TBARS value were performed as described early.
- Microbiological analysis: APC and total mold count (ISO/CD 21527, 2001) were investigated.
- Detection of the lipid profile: Fat was extracted from formulated burger using the method of Bligh and Dyer (1959), then the extract was prepared using the method of Naeemi et al. (1995). Cholesterol (Ellefson and Caraway, 1976), Triglycerides

Links Researchers

Table 1: Composition of various beef burger formulations.

Formulation	Ingredients									
	Lean beef (g)	Beef fat (g)	Rice bran oil (mL)	Olive oil (mL)	Soy flour (g)	Salt (g)	Sodium triphosphate (g)	Dried onion (g)	Spices mixture (g)	Cold water (mL)
Control	625	200	-	-	40	15	2	3	15	100
F1	625	100	-	100	40	15	2	3	15	100
F2	625	100	100	-	40	15	2	3	15	100
F3	625	-	100	100	40	15	2	3	15	100
F4	625	-	-	200	40	15	2	3	15	100
F5	625	-	200	-	40	15	2	3	15	100

(Bucolo and David, 1973) were determined. Furthermore, HDL-cholesterol was measured via precipitation method of Warnick and Wood (1995) and calculation of LDL-cholesterol in mg/100 ml (Friedewald et al., 1972) was performed.

Statistical analysis

The obtained data were subjected to the analysis of variance using Statistical Package for the Social Sciences (SPSS) software. The significance was defined at $p < 0.05$.

RESULTS

Nutritive value of marketed beef burger

The proximate analysis of beef burger was presented in Figure 1. The highest protein percentage was in group D (10.47% ± 3.5%), which was prepared in a local market in Qena, followed by group A, B and the lowest percentage was in group C. Group B had the highest moisture content, followed by groups D, A, and C respectively. Fat analysis showed that Group C was the highest, while group B was the lowest. It is noticed that the ash and carbohydrate percentages had not been significantly differed among the examined burger groups. The energy value was the highest in group C and the lowest in group B (Table 2).

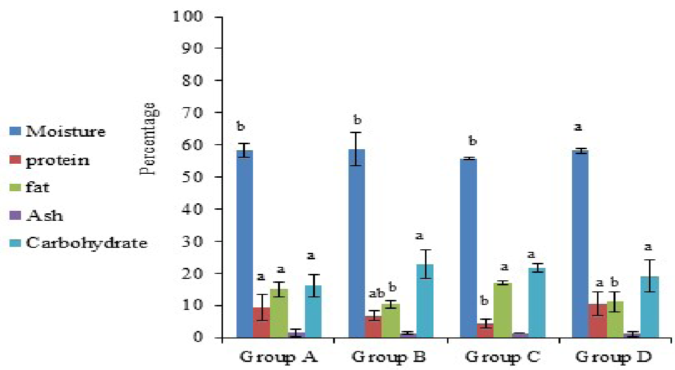

Figure 1: Nutritional profile of various classes of Egyptian beef burger. Percentage of moisture, protein, fat, ash and carbohydrate. Data are mean ± standard deviations. Various letters indicated a statistically significant difference between the means at $p < 0.05$.

Table 2: Total energy in the marketed beef burger groups.

Groups	Total energy (Kcal/ 100 gm)
Group A	236.6 ± 19.2^{a}
Group B	211.06 ± 26.1^{a}
Group C	256.49 ± 4.3^{a}
Group D	218.10 ± 73.5^{a}

The result was presented as mean ± standard deviations. Different letters in each column indicated significant difference ($p \leq 0.05$).

Assessment of quality aspects of the marketed beef burgers

The pH , APC and TBARS values were acceptable in all exmained groups. Howerver, TVB-N was accepted in group C and D, but it exceeded the limit in group A and B (Table 3).

Table 3: Quality aspects of the marketed beef burger groups.

Groups	pH	APC (CFU/g)	TVB-N (mg/100g)	TBARS (mg/kg)
Group A	6.1 ± 0.08^{a}	$2x10^{4} \pm 1x10^{4b}$	21.5 ± 5.1^{a}	0.20 ± 0.05^{a}
Group B	6.08 ± 0.16^{a}	$6x10^{3} \pm 2x10^{3a}$	20.4 ± 5.2^{a}	0.19 ± 0.11^{a}
Group C	5.85 ± 0.09^{ab}	$2x10^{3} \pm 1x10^{3a}$	17.9 ± 5.1^{a}	0.18 ± 0.10^{a}
Group D	5.73 ± 0.40^{b}	$2x10^{2} \pm 2x10^{2a}$	11.2 ± 2.6^{b}	0.12 ± 0.03^{a}

The result was presented as mean ± standard deviations. Different letters in each column indicated significant difference ($p \leq 0.05$).

The influence of olive and rice bran oils on the quality of beef burgers

Proximate composition

Figure 2 illustrated the nutritional value of different beef burger formulations. F2 had the highest moisture content (65.43% ± 0.8%), while F3 had the lowest (59.47% ± 1.4%). There were no statistically significant differences in protein values between various formulations. It was noticed that the fat percentage for the control group was (16.06% ± 2.6%) which was greater than other formulations. A significant reduction in the fat content was obtained in F1 and F2 in which beef fat was partially replaced with olive and rice bran oils as well as in F5 where beef fat was totally replaced by rice bran oil. The ash percentage was ranged from 1.02% ± 0.05% to 1.25% ± 0.15% in various groups. Carbohydrate content varied between 5.52% ± 1.4% to 12.06% ± 4%.

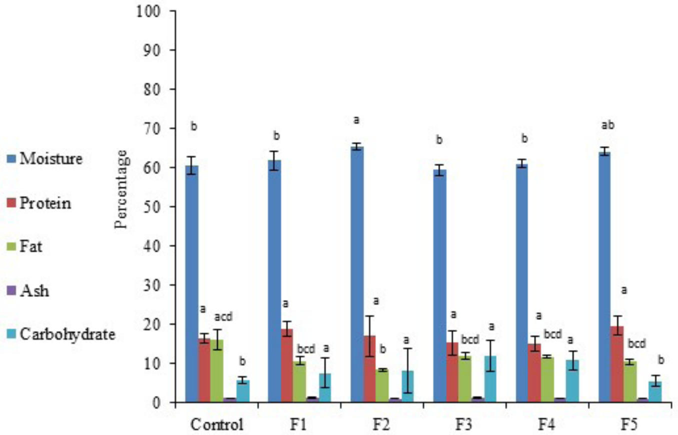

Figure 2: Nutritional profile of various formulated beef burger. Percentage of moisture, protein, fat, ash and carbohydrate. Data are mean ± standard deviations. Various letters indicated a statistically significant difference between the means at $p < 0.05$.

The mean of total energy value of control group (233.34 ± 21.4 kcal/100 gm) was greater than all other formulations. A significant decrease was noticed in F2 and F5 (176.05 ± 1.4 kcal/100 gm and 195.37 ± 10.0 kcal/100 gm, respectively). Other formulations including, F1, F3 and F4 showed non-significant decrease in the total energy value compared to the control group (Table 4).

Table 4: Total energy for various formulated beef burgers.

	Total Energy (Kcal/ 100 gm)
Control	233.34 ± 21.4^{a}
F1	201.42 ± 10.7^{b}
F2	176.05 ± 1.4^{b}
F3	216.94 ± 8.7^{a}
F4	209.74 ± 5.8^{b}
F5	195.37 ± 10.0^{b}

The result was presented as mean ± standard deviations. Different letters in each column indicated significant difference ($p \leq 0.05$).

Microbiological analysis

The results in Figure 3 revealed the impact of adding various concentrations of olive and rice bran oils to beef burgers on the APC. The F1 and F2 exhibited a significant decline on days 7, 14 and 21 compared to the control group.

Mould growth was estimated on day 21, while on day 7 and 14 there was no growth. The mean of mould count of the control group was the highest (1 x 10^{5} CFU/g) with significant decrease was observed in F1 group (3 x 10^{4} CFU/g) and F2 (3 x 10^{4} CFU/g) (data not shown).

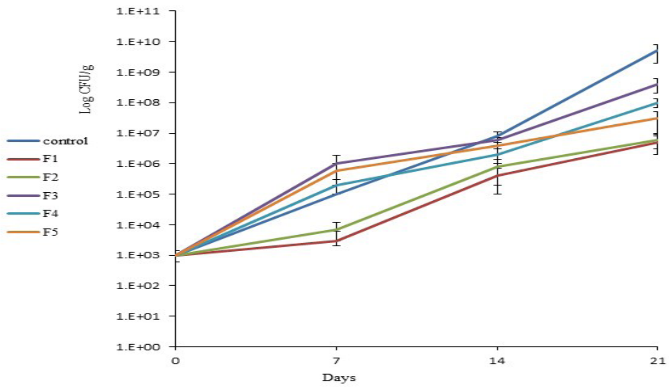

Figure 3: APC of various formulated beef burger. Data are mean ± standard deviations.

Sensory evaluation

It was noticed that the control samples had excellent color, odor till the day 7 of the cold storage, and then declined gradually at the day 14 till had a bad color, consistency and odor at the day 21 of the cold storage.

F1 and F2 showed excellent color and consistency till the day 7 of cold storage while the odor was excellent till day 14 in burgers of F1 and for the day 7 for F2. Consistency in both groups (F1 and F2) was very good till the day 14 of the cold storage then began to deteriorate.

F3, F4 and F5 groups which weren't contain any amount of beef fat, color was good till day 7 then deteriorate. Odor, was excellent till day 7 for F3 then started to decline, while for F4 and F5 was very good till the day 7then started to decline. Consistency for F3, F4 and F5 was less desirable than the control. This could be attributed to the lack of beef fat in these groups and their high oil content.

Taste was examined after frying, it was excellent for F2 from the day zero then declined to good till the day 14, whereas the taste of the other groups was poorer from day zero to day 14 (Table 5).

Cooking loss

At 0, 7, 14, and 21 days, the control group showed much higher cooking loss than other groups. F2 demonstrated less cooking losses than other formulations during the experiment (Table 6).

pH Value

Control samples showed greater pH values in comparison to other groups. F1 had the most acceptable values during the experiment (Figure 4).

TVB-N

Control samples exhibited higher TVB-N values than other groups. Furthermore, on days 14 and 21 both control and F3 exceeded the permissible limit (20 mg/100g according to ESS, 2005). F1 and F2 exhibited the best values for TVB-N (Figure 5).

Table 5: Sensory evaluation of various formulated beef burgers.

	Sensory evaluation					
	Control	F1	F2	F3	F4	F5
Color						
Day 0	5	5	5	4	4	3
Day 7	5	5	5	3	3	3
Day 14	2	3	3	2	2	1
Day 21	1	1	1	1	1	1
Odor						
Day 0	5	5	5	5	5	5
Day 7	5	5	5	5	4	4
Day 14	2	5	4	2	1	1
Day 21	1	1	1	1	1	1
Consistency						
Day 0	5	5	5	2	2	2
Day 7	3	5	5	2	2	2
Day 14	1	4	4	2	2	2
Day 21	1	1	1	1	1	1
Taste						
Day 0	4	4	5	3	2	1
Day 7	3	4	4	2	1	1
Day 14	0	2	3	0	0	0
Day 21	0	0	0	0	0	0

5: excellent, 4: very good, 3: good, 2: satisfactory, 1: bad, 0: very bad.

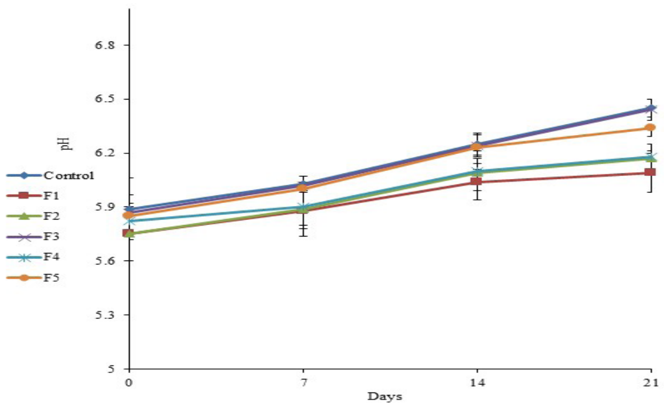

Figure 4: pH values of various formulated beef burger. Data are mean ± standard deviations.

TBARS

Control and F3 groups showed the greater TBARS values throughout the investigation. On the other hand, F1 and F2 demonstrated the most acceptable values (0.9 mg/kg according to ESS, 2005) (Figure 6).

Table 6: Cooking loss percentage of various formulated beef burgers.

	Cooking loss %			
	Day 0	Day 7	Day 14	Day 21
Control	15.13±0.61	26.7 ± 1.8^{a}	20.6 ± 2.04^{a}	19.7 ± 0.3^{a}
F1	9.82±0.13	15.85 ± 2.01^{b}	10.84 ± 0.23^{bc}	6.7 ± 1.0^{b}
F2	7.62±0.23	13.28 ± 1.9^{b}	5.8 ± 1.3^{b}	5.9 ± 1.5^{b}
F3	12.57±3.09	17.21 ± 2.19^{b}	16.2 ± 2.34^{b}	9.3 ± 1.6^{bd}
F4	13.96±1.38	21.67 ± 1.9^{b}	18.28 ± 2.62^{a}	16.08 ± 1.5^{bc}
F5	11.13±0.36	16.89 ± 2.39^{b}	13.02 ± 0.98^{bc}	6.9 ± 0.7^{b}

The result was presented as mean ± standard deviations. Different letters in each column indicated significant difference ($p \leq 0.05$).

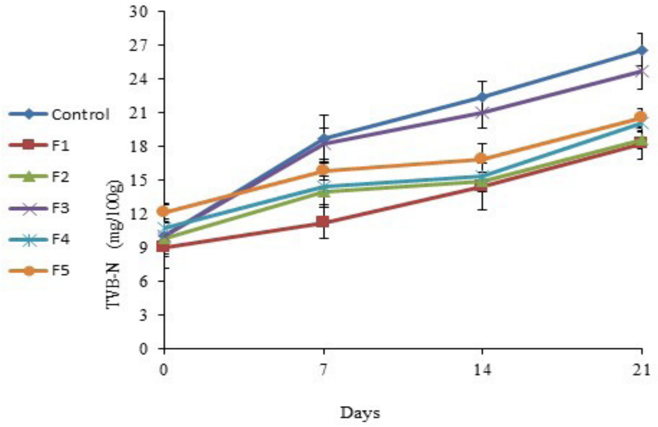

Figure 5: TVB-N values of various formulated beef burger. Data are mean ± standard deviations.

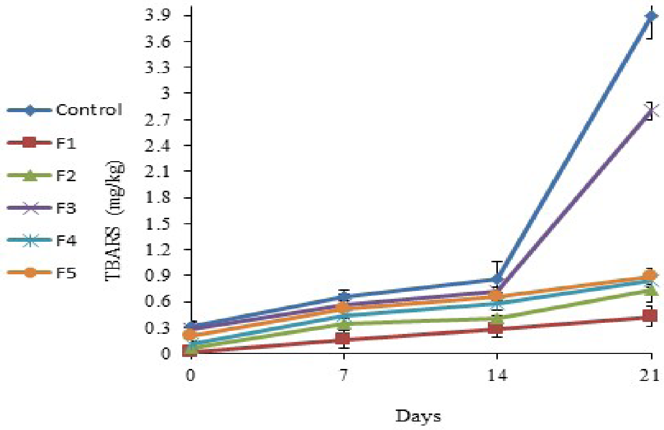

Figure 6: TBARS values of various formulated beef burger. Data are mean ± standard deviations.

Total lipid profile

The obtained results showed that the control group had the highest cholesterol, triglycerides and LDL values in comparison with other groups. Furthermore, the control samples had the lowest HDL values (Table 7).

Table 7: Total lipid profile of various formulated beef burgers.

	Cholesterol (mg/100g)	HDL (mg/100g)	Triglycerides (mg/100g)	LDL (mg/100g)
Control	88.14±26.63[a]	0.11±0.05[bc]	258.77±20.09[a]	88.03±26.59[a]
F1	65.24±10.85[a]	0.49±0.08[bc]	217.61±21.24[b]	64.75±10.91[b]
F2	56.73±11.99[b]	0.49±0.14[bc]	215.74±6.02[b]	56.23±12.13[b]
F3	55.55±0.32[b]	2.91±0.71[b]	252.1±6.76[a]	52.65±0.99[b]
F4	38.27±3.85[b]	7.32±0.51[a]	141.18±7.3[b]	30.95±3.37[b]
F5	39.5±5.95[b]	5.28±0.28[b]	158.3±30.3[b]	34.22±5.76[b]

The result was presented as mean ± standard deviations. Different letters in each column indicated significant difference ($p \leq 0.05$).

DISCUSSION

Beef burgers are a popular food with appealing organoleptic characteristics and low pricing, as well as a high nutritional value. The protein content of the different burger groups varied due to the different cuts and amounts of meat added. According to the Egyptian standard specification (ESS, 2005), the protein content of Egyptian burger should not be less than 15%. In comparison with the obtained data, none of the examined groups matched with the ESS. Because of its legal value, label standards, bacterial stability, and meat-manufacturing requirements, moisture percentage is one of the most measured components in processed meat. The ESS (2005) showed that the permitted limit of moisture is 60%, which is substantially identical to the obtained findings. A number of factors affecting on the moisture content in the examined samples, including the volume of meat contained (Mahmoud et al., 2016).

Fat has a significant impact on organoleptic characteristics and product durability in the processed beef. The obtained results were lower than the fat limit described by the ESS (2005) which demonstrated that the permissible limit of fat is about 20%. These findings are agreed with that was reported by Babji and Yusof (1995).

Ash content in meat is a measurement of the total minerals present. These findings are lower than those mentioned by Babji and Yusof (1995), who showed that ash content of processed beef burgers ranged from 1.8% to 2.6% as well as Rowaida et al. (2019) mentioned that ash content of burger locally produced and burger of commercial companies ranged from 5.20% to 5.71%.

Carbohydrates were frequently present in trace amounts in raw meat. Carbohydrate content in meat products represented non-protein ingredients such as starches and grains. The observed results were within the range reported by Babji and Yusof (1995) who stated that carbohydrate percent in beef burger ranged from 0.7 to 23.5 percent.

APC valuses were within the permissible limits (10^6) according to ESS (2005). The obtained results agreed with that found by Hamed et al. (2015). All TBARS results were within the permissible Egyptian limits, although the variations in TBARS values between groups could be attributable to poor handling of the meat during processing and long storage time, allowing the fat to oxidize (Hassanien et al., 2018).

Excessive eating of processed meat, particularly burgers, is a widespread practice that leads to an unbalanced intake of saturated fatty acids, which have been linked to a variety of illness.

In comparison to the control samples, substituting rice bran oil for beef fat in partially replacement (F2) increased the moisture percent. On the other hand, the protein content was unaffected by the substitution of animal fat.

Fat content was significantly greater in control samples in compared to other formulations. The reduction in fat content was more clear in both partial (F2) and total replacement of beef fat with rice bran oil (F5) groups than other groups, which is beneficial for patients with cardiovascular diseases who require low-fat products. Hence, rice bran oil has been dubbed a heart friendly oil. The findings were consistent with those reported by Karema and Badr (2011) and Selani et al. (2016). Total energy data showed that replacing beef fat with vegetable oils reduced total energy value in comparison with control. The use of rice bran oil had a greater impact on total energy reduction than olive oil. These findings will help in the development of diets for patients with cardiovascular problems.

APC of F1 and F2 formulations was significantly lower and within the acceptable range till day 21 compared to the other groups. Furthermore, mould count in F1 and F2 was lower than other groups. That could be attributable to olive oil's antimicrobial properties, which was linked to its phenolic components, particularly oleuropein, which has a variety of biological activities including antioxidant, antimicrobial, antiviral and anti-inflammatory prosperities (Sikora et al., 2008). Olive oil also has strong antibacterial capabilities due to its high content of beneficial mono-unsaturated fatty acids (Servili et al., 2009). Rice bran oil is abundant in mono-unsaturated fatty acids (Westrate and Meiger, 1998).

Consumers' food choices are greatly influenced by organoleptic properties. The obtained results revealed that at zero and day 7 of cold storage, there were no differences in color, odor and consistency between the control group and groups of partial replacement of beef fat with olive oil and rice bran oils (F1 and F2). However, other formulations differed from the control group in color, odor, and consistency. The findings revealed that adding rice bran oil to beef burger had a better taste than adding olive oil, which could be owing to the presence of bitter-tasting flavonoid polyphenols in olive oil (Owen et al., 2004). This was supported by Moon et al. (2012) who revealed that adding olive oil resulted in a quite undesirable color and overall acceptability, but it prevented lipid oxidation.

Cooking loss was greater in the control group than other formulations, which might be attributable to significant fat separation and water release during cooking (Karema and Badr, 2011). Moreover, substituting vegetable oil for beef fat resulted in lower cooking loss of meat products (Park et al., 2005).

TVB-N for F1 and F2 was still acceptable until day 21. These findings revealed that partially replacing beef fat with olive and rice bran oils reduced protein oxidation, with partial replacement being better to the entire replacement. The decreased TVB-N levels of the formulated samples compared to the control samples may be due to the efficiency of olive and rice bran oils against spoilage microorganisms. The activity of spoilage bacteria and endogenous enzymes is linked to the increase in TVB-N values during storage (Ocano-Higuera et al., 2011). The obtained results agreed with that mentioned by Robiel et al. (2017) who reported that the means of TVB-N values of control group were higher than that of other treatments along the cold storage period till 14 days. In this study, the TVB-N results supported the findings of the microbiological and sensory analyses.

The pH value was most acceptable in F1 and F2 compared to the other groups. That attributed to lower bacterial count and TVB-N values in these groups. The rise in pH could be owing to partial proteolysis caused by bacteria resulting in an increase in free alkaline groups (Jay, 1972).

The TBARS value is a crucial test for determining the degree of lipid oxidation in meat and meat products. F1 and F2 showed better results than other formulations. The obtained results were consistent with Kim et al. (2000), who reported that TBARS values for rice bran oil formulated samples were lower than control samples at 0, 7 and 14 days of cold storage. Olive oil contains flavonoid polyphenols, which are natural antioxidants. Rice bran oil also contains the phytochemicals oryzanol, tocopherols and tocotrienols, which function as antioxidants and give it a longer shelf life than other edible oils.

The results showed that replacing beef fat with either olive or rice bran oils reduced cholesterol levels in beef burgers compared to using beef fat alone in the control group, which will assist to reduce all health risks associated with high cholesterol levels in meat products. This agreed with Al-Marazeeq et al. (2009) who revealed that replacing of beef fat with olive oil reduced cholesterol level in olive oil formulated samples. Dominguez et al. (2016) also revealed that adding olive oil lowers cholesterol levels. In same context, Kim and Godber (2001) reported that the cholesterol content of rice bran oil formulated samples was lower than the control. Oryzanol, a unique phytochemical found in rice bran oil, is known for its cholesterol-lowering benefits. HDL cholesterol is known as the "good" cholesterol type because it protects against heart attack and stroke. The obtained results indicated that HDL concentration increased more in the formulations with total replacement of beef fat with vegetable oils (F4 and F5). Both oils used in F3 raised the HDL concentration more than that of F1 and F2, which could be due to a combination of antioxidants found in both oils, such as carotenoids, vitamin E and K, polyphenols, tyrosol, and oleuropein, as well as oleic acid in olive oil. In addition to, phytochemical oryzanol, tocopherols, and tocotrienols in rice bran oil. LDL cholesterol is regarded as bad cholesterol since it leads to fatty accumulation in blood vessels, constricting them and raising the hazard of cardiovascular stroke (AHA, 2020). The high decrease in the LDL values in F3, F4 and F5 groups where the beef fat was totally replaced either by both oils or by one of them is due to the richness of olive and rice bran oil with mono- unsaturated fats and cholesterol and rice bran oil had also been proved to be effective in decreasing the bad cholesterol type (LDL) by 7-10% (Westrate and Meiger, 1998).

Triglycerides are prevalent form of fat in the body, and they are responsible for storing extra energy from our food. Elevated triglyceride level in combination with high LDL cholesterol are responsible for heart diseases. Triglycerides results indicated that using either total beef fat or total replacement of beef fat with both oils have higher triglycerides than using one of the vegetable oils either partially or totally. Rice bran oil aids in the reduction of triglycerides and the improvement of the good cholesterol to bad cholesterol ratio, both are required for good heart performance (Rukmini, 1988).

CONCLUSIONS AND RECOMMENDATIONS

The current study revealed useful data about the proximate composition and quality aspects of different groups of Egyptian burgers. The high price group D burger was rich in protein than other groups. All the examined burger groups were within the permissible limits for quality parameters with more preferable results in the locally processed, high price group D than other groups. Replacing of beef fat with olive oil or rice bran oil either partially or totally decreased fat content in comparing with the control group which is very helpful for patients with cardiovascular diseases. Using olive oil or rice bran oil in burger formulations resulted in acceptable levels for color, odor, consistency and cooking loss but partial adding of rice bran oil was preferable in taste than olive oil. The oxidative stability and shelf-life time of beef burger formulated using partial replacement of beef fat with either olive or rice bran oil was improved. Partial or total replacement of beef fat with either olive or rice bran oil decreased cholesterol, triglycerides and LDL with increase in the HDL levels. According to the findings of this study, using olive and rice bran oils to substitute beef fat in beef burgers can be an efficient way to lower fat content when compared to traditional products, without altering the product's sensory characteristics. More research into the fatty acid profiles will be beneficial.

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AUTHOR'S CONTRIBUTION

Conceptualization, A.R.F., H.Y.A., E.S.E. and M.A.M.; Methodology, A.R.F., H.Y.A., E.S.E. and M.A.M.; Practical work and acquisition of the data, A.R.F. and M.A.M., Analysis and interpretation of the data, A.R.F. and M.A.M.; writing and editing, A.R.F. and M.A.M.

Conflict of interest

The authors have declared no conflict of interest.

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