استخدام أوراق الخرشوف في كرات اللحم كمنتج وظيفي

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Use of Artichoke Leaves in Meatballs as a Functional Product

ABSTRACT:

Numerous studies have been demonstrated the beneficial effects of dietary fiber (DF) consumption in prevention heart disease, cancer, cholesterol, lipid regulation of glucose absorption, insulin secretion and constipation. Meats are undoubtedly major source of proteins with high biological value. However, most of the meat products are deficient in fiber. The aim of this study was to use artichoke leaves (AL) (Cynara scolymus L.) in meatballs to reduce the caloric content by fat substitution. Meatballs were prepared from meat fortification with four different level of artichoke leaf powder "AL" (2.5, 5, 7.5, and 10 %). The results revealed that the meatballs were high contained in fiber, protein and low amount low in fats. The sensory evaluation of the meatballs gives acceptable sensory result in levels 2.5 and 5% AL, while 7.5 and 10% meatballs of AL were less acceptability. As well as study of texture properties in supplemented meatballs indicated that adding AL in meatball showed the highest effect on firmness, chewiness and gumminess , no significant differences between springiness and resilience. While showed significant decrease differences between cohesiveness, Meatballs containing artichoke leaves had lower of saturated fatty acids and higher of unsaturated fatty acids compared to the control and there was a significant increase in unsaturated fatty acids by the addition of fiber through artichoke leaves. It can be recommended that the necessity to adding 2.5, 5, 7. 5 and 10% of artichoke leaves when making meatballs, to increase the meatballs' content of dietary fiber and protein and decrease their saturated fat content, which reflects the importance of consumption for patients with hyperlipidemia.

Key words: artichoke leaves, meatballs**,** chemical composition, sensory evaluation, texture properties.

Introduction:

The American Heart Association and other health organization, it recommends consumers to reduce the amount of dietary fat intake **(Yilmaz, 2005)**

With the increased attention to reduce fat intake and low fat meat products are modified to be healthier **(Isikli *et al.*, 2002)**

Meat contains fat, that varying amount of fat, under the skin and around organs especially heart and kidney **(Rabia et *al*., 2018)**

And also, meat and meat products are rich with nutrients such as proteins, lipids, vitamins and minerals; it is healthy diet **(Angel and Olga, 2017)**.

Meat contains a large amount of fat and this leads to several health problems **(Fernandez et *al*., 2005).**

Dietary fiber has been used in meat products to demonstrate their beneficial effects on health and also as an alternative to fat **(Suman, 2015).** So**,** DF provides meat products with high fiber and low fat **(Nuntaporn *et al*., 2015).** Artichoke leaf is a source of fiber **(Frutos *et al.*, 2008)** and also, it is a rich source of poly phenolic compounds **(Maryem et *al*., 2015)**. The antioxidant activity of artichoke leaves extract used in a beneficial diet **(Haluk *et al*., 2018)**

Moreover, artichoke leaves extract is well efficacious in increasing HDL-C and in decreasing LDL-C **(Mariangela et *al*., 2012)**

And also, artichoke leaf have showed a significant decrease in levels of glucose, cholesterol, artherogenic index and cardiovascular disorders **(Maryem *et al*., 2015)**

Artichoke leaves rich in antioxidants so, have cholesterol reducing effect **(Canan *et al*., 2010)**

Artichoke (Cynara scolymus) leaf was one of the few herbal pharmacological researches. And also, it has antioxidant, and lipid-lowering effects **(Maryem *et al*., 2015)**

The leaf of artichoke is used as an antimicrobial, anti-inflammatory, hepatic protective, cholesterol, lipid and glucose lowering due to it containing antioxidants **(Colak *et al*., 2016)**

Artichoke leaf can be used Due to its rich basic composition and high levels of antioxidants **(Wioletta *et al*., 2020)**

Herbal syrup of chicory and artichoke leaves extracts can decrease liver damage. Agriculture wastes of chicory and artichoke leaves is products an easy, economical, and useful **(Samia and Abdel- Tawab, 2020)**

And the end, artichoke leaf can be added to meat, for its aroma and to protect meat from lipid oxidation **(Wioletta *et al*., 2020)**

So, artichoke leaves are used as an herbal medicine for their beneficial and therapeutic effects **(Mona *et al*., 2016)**

Meat is important, its production and consumption has risks for human health. It must modify their use with health food that reduces their harmful. Thus, the aim of this study was to use artichoke leaves in meatballs to reduce the caloric content by fat substitution.

Materials and Methods:

Materials:

Artichoke leaves were obtained from a local market in Cairo, Egypt. They were dried and grinded into powder. The dried artichoke leaves powder was kept in seal plastic bag at below 4°C until analysis

Meat, fat, black pepper, red pepper, cumin, onion, garlic and salt were purchased from the local market in Damietta, Cairo, Egypt.

Methods:

Meatball samples were produced according to following traditional recipe. The veal (including 10% fat) was ground, and different seasonings (ground black pepper 0.1%, red pepper 0.2% and cumin 0.4%) and some other ingredients (onion 3%, garlic 0.5%, and salt 2%) were added to the ground veal. The mix was kneaded for 15 min by hand and the meatball dough obtained was divided into five equal portions, artichoke leaves were added in to the meatball samples was incorporated at the level of 2.5, 5, 7.5 and 10%, respectively.

And then shaped into 2 cm diameter meatballs with a weight of 18–20 g before cooking. The meatball samples were cooked in preheated (160 °C) electric grill and cooked 3 min on one side, turned over and cooked for a further 3 min **(Zeynep *et al*., 2014)**

Cooking yield:

Cooking yield was measured by calculating weight differences of meatballs before and after cooking **(Murphy *et al*., 1975)**

$$\text{Cooking yield (\%)} = \frac{\text{Cooked weight}}{\text{Uncooked weight}} \times 100$$

Chemical analysis

Moisture, protein, fat, crude fiber and ash, were determined as described in **A. O. A. C. (2000)**, while total carbohydrates were calculated by the differences equation carbohydrates (%) = [100 – (moisture + fat + protein + crude fiber + ash)].

Antioxidant capacity was determined by the method of **Gaoa *et al*., (1998).**

Texture profile analysis was determined by **Bourne, (2003).**

Fatty acid analysis

Total fatty acids were measured in homogenized meatball using a modification of AOAC official method **(A.O.A.C .1990).** All necessary procedures for sensory evaluation were applied

Sensory evaluation:

Sensory evaluation was performed by invited ten panelists of staff members from Home Economics Department, Specific Education Faculty of Damietta University. Each panelist was asked to evaluate unfortified and fortified meatball samples with Artichoke leaves, according to color, Flavor, taste, texture and general appearance **(Abd El-Latif, 1990).** All necessary procedures for sensory evaluation were applied.

Statistical analysis:

Statistical analysis were performed by using computer program, statistical package for social science **(spss, 1998)**, and compared with each other using the suitable tests.

Results and Discussion:

The gross chemical composition of artichoke leaf powder "AL" is presented in Table (1) the main composition in artichoke leaf powder is carbohydrate (46.42 %). The amount of crude fiber, total protein, moisture, fat and ash are decreased as compared to carbohydrates. Total antioxidant capacity was 228.84 mg/ 100 g **Mona *et al*., (2016)** reported the protein content of artichoke leaf

(d.w.) was in the range of 8.05% to 12.35%, fat 2.34%, crude fiber 31.47% and carbohydrates 48.63%. These results are in agreement with those reported by **Canan *et al*., (2010)**, **Frutos *et al*., (2008) and Wioletta *et al*., (2020).**

Table (1) chemical analysis of Artichoke leaves "A. L" powder

Component g/100g	**Artichoke leaf(A. L)**
Crud protein	10.3 %
Fat	3.43 %
Moisture	5.6 %
Ash	2.6 %
Crud fiber	31.65 %
Total carbohydrates	46.42 %
Total antioxidant capacity	228.84 mg / 100 g

Data in table (2) shows the chemical composition of meatballs fortification with AL (on dry weight basis).

Artichoke leaf fortification meatballs with 2.5, 5, 7.5 and 10 % of artichoke leaf showed decreased the amount of fat and moisture contents for all supplementation levels relative to the control meatballs, this might be due to it lowers the value of water holding capacity of protein in the meatball. On the other hand, addition of artichoke leaf powder, it also increases the amount of protein, ash and crude fiber. So, this is good for meatballs because their nutrient contents improved.

These results agree with that obtained by **Maroua *et al*., (2016)** who reported that the results showed that the crude fiber content increased by increasing AL concentration.

Table (2) proximate composition of meatballs fortification with AL (on dry weight basis)

Component	control	2.5% AL	5% AL	7.5 %AL	10% AL
Moisture	71.5	71.36	71.22	71.08	70.94
fat	1.89	1.46	1.13	0.81	0.47
ash	2.04	5.68	6.90	7.09	8.30
Crude fiber	0.07	5.67	6.47	9.26	11.64
Crude protein	24.50s	15.83	14.28	11.76	8.65

Data in table (3) shows the Cooking properties of meatballs with artichoke leaf cooking yield of meatballs decreased when artichoke leaf addition in meatballs. Cooking yield varied between (83.62) % to (90.22) meatballs produced; with the addition of 2.5% and 5% artichoke leaf had not significantly difference from control (90.22). While, with the addition of 7.5% and 10% artichoke leaf powder had significantly difference from control (90.22). These results agree with that obtained by **(Nuntaporn *et al*., 2015)** who reported that the results showed that the Cooking yield of meatballs decreased when the amount of artichoke leaf increased in meatballs. Returns the Cooking yield is reduced due to lower fat and moisture.

Table (3) cooking properties of meatballs with AL powder

cooking properties	control	2.5% AL	5%AL	7.5%AL	10%AL
Cooking yield (%)	90.22^{a}	89.83^{a}	88.89^{a}	84.54^{b}	83.62^{b}

Data in table (4) showed that sensory characteristics of meatballs substituted with artichoke leaf powder at different levels control, 2.5, 5, 7.5 and 10% are presented in table (4) results showed in non- significant changes in most sensory characteristics as compared to control. The color for the meatballs were significantly increases ($p < 0.05$) by the addition of 7.5 and 10% (AL) whereas, the color of meatballs samples supplemented with

2.5% and 5% showed significant decrease, as compared to the other samples. On the other hand, meatballs supplemented with 2.5% AL recorded non- significant changes in taste and flavor, while others samples supplemented with 5%, 7.5% and 10% were slight lower than control meatballs. Results in the same table indicated that, texture of meatballs samples decreased significantly when adding different levels of AL to the meatballs, statistical analysis showed non- significant changes in general acceptability between two meatballs

Samples supplemented with 2.5% and 5% of AL as compared to the control. While meatballs samples supplemented with 7.5% and 10% of AL showed significant changes in general acceptability as compared to the control. Evaluation of the taste of meatballs showed that acceptance of products with higher content to AL (7.5 and10%) the negatively effect on color, taste, flavor and texture of final products.

These results agree with that obtained by **(Frutos *et al.*, 2008)** who reported that the results showed higher amounts of AL result in important changes in taste, color and overall appearance. This, in turn leads to less consumer acceptance.

Table (4) sensory evaluation of meatballs supplemented with artichoke leaf powder

Treatments	Color	Taste	Flavor	Texture	general acceptability	Total
	Mean ± S.D **20**	Mean ± S.D **20**	Mean ± S.D **20**	Mean ± S.D **20**	Mean ± S.D **20**	**100%**
control	19.5^{a} ± 0.55	19.2^{a} ± 0.62	19.5^{a} ± 0.55	19.3^{a} ± 0.57	19.5^{a} ± 0.55	97/100
2.5 % AL	19.0^{ab} ± 0.89	19.0^{ab} ± 0.89	18.6^{ab} ± 0.82	18.0^{b} ± 1.09	18.7^{ab} ± 0.83	93/100
5 % AL	18.7^{ab} ± 0.81	17.2^{bc} ± 0.81	17.5^{b} ± 1.87	17.3^{c} ± 0.84	18.6^{ab} ± 0.81	89.3/100
7.5 % AL	16.7^{c} ± 0.83	16.2^{c} ± 0.75	16.3^{c} ± 0.82	16.2^{c} ± 0.75	16.7^{c} ± 0.83	82.1/100
10 % AL	16.2^{c} ± 0.75	16.2^{c} ± 0.75	16.2^{c} ± 0.75	16.1^{c} ± 0.74	16.5^{c} ± 0.72	81.2/100

Data in table (5) showed that by increasing the concentration of AL, saturated fatty acids are lower in meatballs.
The figure (1) clears this.

Table (5) levels of saturated fatty acids in meatballs supported by AL

Fatty acids	Concentrations artichoke leaf powder				
	0%	2.5%	5%	7.5%	10%
C12:0	0.17%	0.17%	0.16%	0.16%	0.16%
C14:0	2.27%	2.27%	2.27%	2.24%	2.21%
C15:0	0.90%	0.87%	0.84%	0.83%	0.82%
C16:0	22.48%	22.21%	21.94%	21.80%	21.66%
C18:0	21.04%	20.83%	20.62%	20.60%	20.57%
C20:0	0.14%	0.13%	0.12%	0.12%	0.12%
Total saturated fatty acids	**7.83%**	**7.75%**	**7.66%**	**7.62%**	**7.59%**

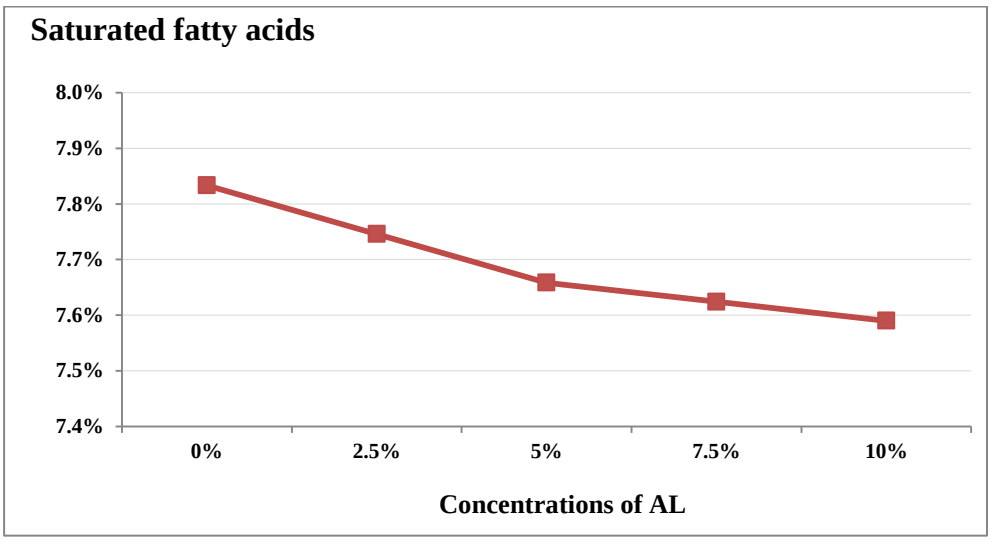

Figure (1): The averages of saturated fatty acids ratio according to concentration levels of AL

Data in table (6) showed that by increasing concentration of AL monounsaturated fatty acids in meatballs increase.
The figure (2) clears this.

Table (6): Monounsaturated fatty acids in meatballs supported by AL

Fatty acids	Concentrations artichoke leaf powder				
	0%	**2.5%**	**5%**	**7.5%**	**10%**
C14:1	0.16%	0.17%	0.18%	0.18%	0.18%
C16:1	0.33%	0.36%	0.39%	0.40%	0.41%
C18:1w9	37.62 %	38.02 %	38.41 %	38.46 %	38.51 %
C18:1w7	4.17%	4.28%	4.39%	4.40%	4.41%
Total Monounsaturated fatty acids	**10.57 %**	**10.71 %**	**10.84 %**	**10.86 %**	**10.88 %**

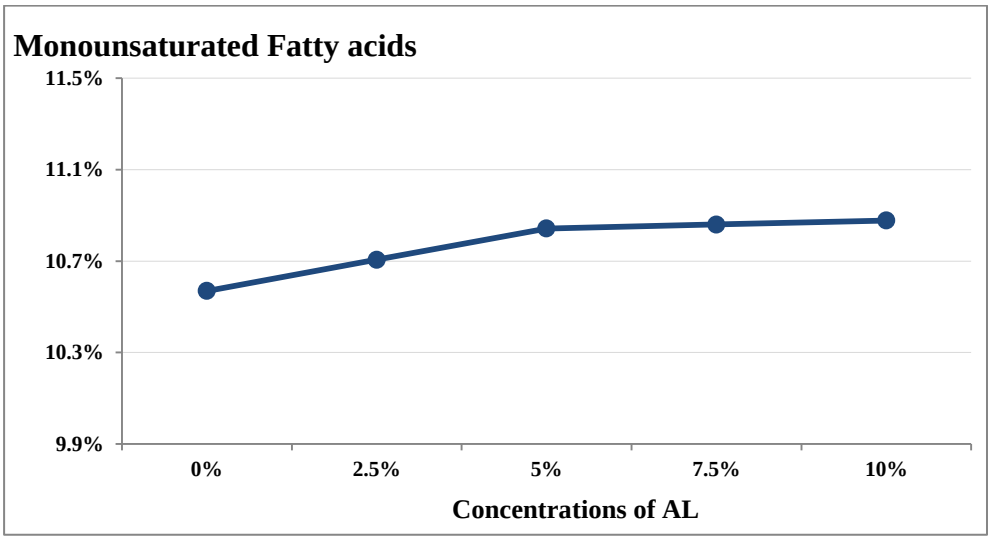

Figure (2): The averages of monounsaturated fatty acids ratio according to concentration levels of AL

Data in table (7) showed that by increasing the concentration of AL, poly unsaturated fatty acids in meatballs increase.
The figure (3) clears this.

Table (7): Poly unsaturated fatty acids in meatballs supported by AL

Fatty acids	Concentrations artichoke leaf powder				
	0%	2.5%	5%	7.5%	10%
C18:2w7	0.18%	0.22%	0.26%	0.27%	0.27%
C18:2w6	4.43%	4.47%	4.50%	4.61%	4.72%
C18:3w3	0.25%	0.31%	0.36%	0.45%	0.54%
C20:4w6	0.24%	0.26%	0.27%	0.33%	0.38%
Total Poly unsaturated fatty acids	**1.28 %**	**1.31 %**	**1.35 %**	**1.41 %**	**1.48 %**

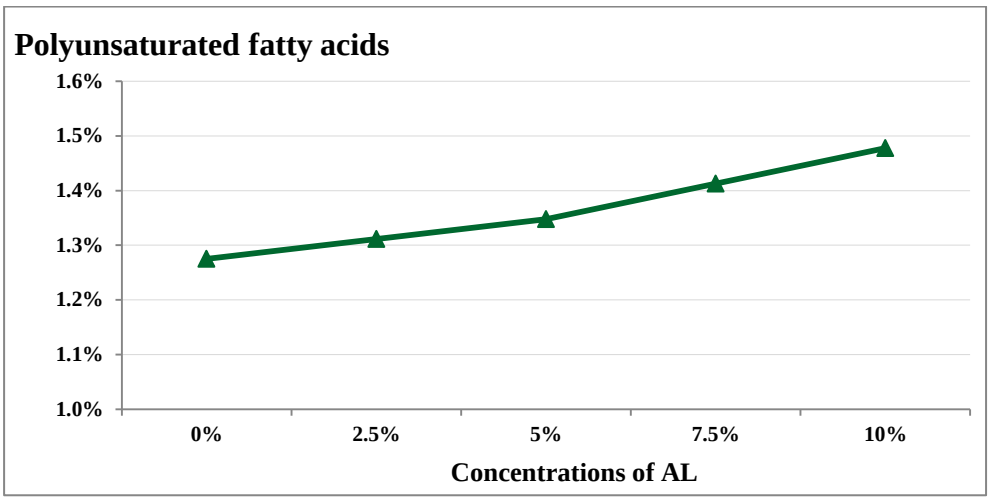

Figure (3): The averages of polyunsaturated fatty acids ratio according to concentration levels of AL

Data in tables 5, 6, 7 showed a decreasing the percent of SFA and increasing the percent of USFA in meatballs supplemented of AL as the fiber in meatballs supplemented of AL increase and that makes it a high quality food

Such data are in accordance with that obtained by **Yilmaz and Daglioglu, (2003)** found that the total USFA increased and SFA decreased significantly as the level fiber in meatballs increased.

In another study **Yilmaz, (2005)** reported that there was a significant increase in poly unsaturated fatty acids by fiber added meatballs.

Data in table (8) showed that there are significant differences between the averages of values at the different concentrations of firmness, gumminess and chewiness and no significant differences between the value averages at the different concentrations of springiness and resilience. While, there are significant decrease differences between the averages of values at the different concentrations of Cohesiveness to the amount of fiber increased in meatballs supplement of AL.

These results agree with that obtained by **Nuntaparn, (2015)** who reported gumminess and chewiness increased with the amount of fiber increased in meatballs. However**,** springiness and resilience showed no significant.

Table (8): Texture properties in meatballs supported by AL

Items	Concentrations	N	Mean ± SE	F	Sig.
Firmness	0%	3	21.17[a] ± 2.93	48.017	**0.001*** **
	2.5%	3	23.16[b] ± 1.41		
	5%	3	25.16[b] ± 1.64		
	7.5%	3	15.85[c] ± 0.53		
	10%	3	6.54[d] ± 1.98		
Cohesiveness	0%	3	0.70[a] ± 0.06	4.074	**0.033***
	2.5%	3	0.68[a] ± 0.06		
	5%	3	0.66[a] ± 0.07		
	7.5%	3	0.50[a] ± 0.15		
	10%	3	0.35[b] ± 0.23		
Gumminess	0%	3	14.97[a] ± 3.13	23.794	**0.001*** **
	2.5%	3	15.79[a] ± 2.26		
	5%	3	16.62[a] ± 2.54		
	7.5%	3	9.29[b] ± 1.54		
	10%	3	1.96[c] ± 0.57		
Chewiness	0%	3	11.58[a] ± 3.18	13.863	**0.001*** **
	2.5%	3	12.07[a] ± 2.20		
	5%	3	12.57[a] ± 2.53		
	7.5%	3	7.11[b] ± 1.39		
	10%	3	1.66[c] ± 0.26		
Springiness	0%	3	0.77[a] ± 0.07	1.050	0.429
	2.5%	3	0.76[a] ± 0.05		
	5%	3	0.75 [a] ± 0.05		
	7.5%	3	0.81 [a] ± 0.06		
	10%	3	0.87 [a] ±0.16		
Resilience	0%	3	0.70 [a] ± 0.10	2.526	0.107
	2.5%	3	0.63 [a] ± 0.05		
	5%	3	0.56 [a] ± 0.06		
	7.5%	3	0.82 [a] ± 0.20		
	10%	3	1.08 [b] ± 0.43		

Conclusion

The results of the present study indicated that AL powder used efficiently as a Functional Product therefore, we recommend the using of AL powder as food additives for their nutritional and healthy benefits on rats.

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استخدام أوراق الخرشوف في كرات اللحم كمنتج وظيفي

الملخص

أثبتت العديد من الدراسات التأثيرات المفيدة لاستهلاك الألياف الغذائية (DF) في الوقاية من أمراض القلب والسرطان والكوليسترول وتنظيم الدهون في امتصاص الجلوكوز وإفراز الأنسولين والإمساك. اللحوم بلا شك مصدر رئيسي للبروتينات ذات القيمة الحيوية العالية. ومع ذلك ، فإن معظم منتجات اللحوم تفتقد وجود الالياف الغذائية. كان الهدف من هذه الدراسة هو استخدام أوراق الخرشوف (Cynara scolymus L.) في كرات اللحم لتقليل محتوى السعرات الحرارية عن طريق استبدال الدهون. تم تحضير كرات اللحم بأربعة مستويات مختلفة من أوراق الخرشوف (2.5 و 5 و 7.5 و 10٪) وأوضحت النتائج أن أوراق الخرشوف تحتوي على نسبة عالية من الألياف والبروتين. وأظهرت نتائج التحليل الكيميائي احتواء كرات اللحم على نسبة عالية من الألياف والبروتين وكمية قليلة من الدهون. أظهرت نتائج التقييم الحسي لكرات اللحم نتائج حسية مقبولة ، في حين أن 7.5 و 10٪ كرات اللحم كانت أقل قبولًا. كما أشارت نتائج الخواص النسيجية في كرات اللحم المدعمة إلى أن إضافة أوراق الخرشوف في كرات اللحم أظهرت أعلى تأثير على firmness وgumminess وchewiness و لم تظهر أي اختلافات كبيرة بين resilience و springiness و في حين أظهرت تأثير ضعيف علي cohesiveness . و تحتوي كرات اللحم المدعمة بأوراق الخرشوف على نسبة أقل من الأحماض الدهنية المشبعة ونسبة أعلى من الأحماض الدهنية غير المشبعة الأحادية مقارنة بالمجموعة الضابطة ، وكانت هناك زيادة ملحوظة في الأحماض الدهنية عديدة عدم التشبع بإضافة الألياف من خلال أوراق الخرشوف. وتوصي الدراسة بضرورة إضافة أوراق الخرشوف بنسبة2.5و5 و7.5و10% عند تصنيع كرات اللحم لزيادة محتوي كرات اللحم من الالياف الغذائية والبروتين ونقص محتوها من الدهون المشبعة والذي يعكس اهمية استخدمها لمرضي ارتفاع دهون الدم

الكلمات المفتاحية: : أوراق الخرشوف ، كرات اللحم ،التركيب الكيميائي ، التقييم الحسي ، خصائص النسيج.