

**Preparation Untraditional Burger by Using Crayfish (*Procambarus clarkii*)**  
**Abd- Elgawad, A. I.; A. E. Qassem; G. A. Ghoneim and S. M. El bhery**  
Food Industries Department, Faculty of Agriculture, Mansoura University, 35516,  
Mansoura, Egypt



### ABSTRACT

This study was designed to evaluate chemical composition of raw crayfish and crayfish burger as untraditional product of new and cheap animal protein to cross-gap in protein deficiency by using crayfish, which is considered as waste resource in Egypt. Physical and chemical properties were determined. It was found that yield of raw tail meat of raw crayfish was about 3.98g being 15% of total weight and it had a high amount of protein (81.13%) and pH value of raw crayfish recorded 7.87. On the other hand, crayfish burger recorded 60.27% of protein and 7.96 pH. Also, the present study showed that heavy metals concentration in raw crayfish and crayfish burger Lead, Zinc and Copper were in the permissible limits. While T.V.N levels were 12.95 and 12.5mg/100 g protein for raw crayfish and crayfish burger, respectively. Amino acids composition of crayfish and crayfish burger presence eight essential amino acids and seven non-essential amino acids. Total essential amino acids in raw crayfish were 46.61 % and total Non-essential amino acids were 53.38%. While, total essential amino acids in crayfish burger were 44.55% and total non-essential amino acids were 55.44%. WHC and plasticity were higher for crayfish burger than raw crayfish. Results of texture profile analysis showed that crayfish burger was acceptable as a high quality product. Total count of bacteria of raw crayfish ( $5.3 \times 10^3$  cfu/g) is higher than that of crayfish burger ( $3.3 \times 10^3$  cfu/g). While, E coli and salmonella sp were not detected in both raw crayfish and crayfish burger samples. A sensory evaluation of crayfish burger showed that overall acceptability recorded 85.00 and crayfish burger was highly accepted for act as marketing product.

**Keywords:** Crayfish, Crayfish burger, Fish burger, Untraditional burger and Burger.

### INTRODUCTION

Crayfish (*Procambarus clarkii*) brought in Egypt in early 1980s for aquaculture (Ibrahim *et al.*, 1995) caused changes in both the structure of ecological environment and the ecosystems. It has successful spread indifferent sites of Nile River (Saad and Emam, 1998). The population of the red crayfish is highly because of its fast growth rate and high fertility it dependent on the interaction between environmental and biological factors. (Gherardi, 2006).

In Egypt, two main periods of recruitment were reported, in May and in December (Emam and Khalil, 1995). It causes a lot of harm to fisheries of the Nile River by attacking the young fish and damages the nets (Ibrahim *et al.*, 1995). This harm makes farmers use pesticides to get rid of *P. clarkii* (Hobbs *et al.*, 1989; Anasta'cio and Marques, 1995 and Jime'nez *et al.*, 2003).

Proposal solutions in Egypt are to eat it. Food microbiological study, 20% of samples of *P. clarkii* are safe for human, while 33.33% are marginally acceptable Elmoasalami and Emara (1999).

Crayfish eaten in Europe and China, prominent in Louisiana. Likewise, for medicinal issue in Egypt, the crayfish *P. Clarkii* feed on vector snails so may be utilized in natural control. Crayfish additionally are critical pointer of water quality. In Egypt meat of *P. clarkia* is prescribed to stand as creature protein for human and its waste can used as fodder (Fisher, 2006 and Baheyeldine, 2007).

Fish burgers are one desirable fast food products (Taskaya *et al.*, 2003; and Chomnawang *et al.*, 2007). Fish burger is valuable product accepted in the world that is sold in frozen form (Suvanich *et al.*, 2000). Fish burger is one important food product of fish that provides the possibility of using pure flesh and protein with high food value of most fishes in producing food process prepared for industrial consumption (Khanipour and Matlabi 2010).

So, this study was carried out to determine the crayfish tail meat (edible part) ability and quality which used to produce an untraditional burger. The produced burger was evaluated as a high quality, new accepted product and cheap source of protein, which we waste it.

### MATERIALS AND METHODS

#### Materials:

**Crayfish samples:** The live red crayfish (*Procambarus clarkii*) harvested from the River Nile at were purchased fisherman in October from (Motobus) Kafr El-Sheikh Government, Egypt. The weight of each crayfish was ranged between 26 to 30 gm.

**Other ingredients:** Wheat flour, corn flour, salt, white pepper, bread crumbs and egg were purchased from the local market of Mansoura City, Egypt.

#### Methods:

##### Preparation of crayfish tail meat:

Crayfish samples transferred immediately to the laboratory, washed carefully with tap water to remove the traces of clay. Samples were washed, beheaded; the carapace was cut and removed. The crayfish tail meat (edible part from crayfish) washing in water and then used during the preparation of crayfish burger.

##### Preparation of crayfish burger:

Cleaned fresh crayfish meat (200g) turned into the mixing bowl. Wheat flour (35 g), corn flour (5g) salt and white pepper added to crayfish meat. Crayfish mixture straightens with 1 cm thickness, and then it put in freezer for about 1 hour, then cutting in equals squares and put in whiskered egg then put in seasoned bread crumbs. Crayfish burger collocated in cork dish then covered with polyethylene and frozen storage at  $-18^{\circ}\text{C}$ .

**Table 1. formula of crayfish burger.**

Ingredient	Gram	%
Crayfish raw tail meat	200	81
Wheat Flour	35	14
Corn flour	5	2
Salt	3	1.5
White pepper	3	1.5
Total	246	100

##### Physical weigh properties of crayfish:

Total weight, head, two clamps, carapace, legs, gut, bones, tail and tail meat were weight at laboratory by using sensitive balance Setezen model cy 204 at Food Industries Dept., Fac. of Agric., Mansoura University.

**Chemical analysis:**

**Gross chemical composition:**

Moisture, crude protein, ash content and total crude fats were determined according to the method described by A.O.A.C. (2002) and total carbohydrates were calculated by difference.

**Total nitrogen and protein nitrogen and non-protein nitrogen**

Total nitrogen (T.N) and protein nitrogen (P.N) and non-protein nitrogen (N.P.N) were determined as described by A.O.A.C (2002).

**Total volatile nitrogen (TVN):**

Total volatile nitrogen (TVN) as indicator of the quality was determined according to Witon and Winton (1958). The modified micro-kjeldahl of Parnars and Wagner as described by Jones *et al.* (1991) was employed for N-determination according to A.O.A.C. (2002)

**Amino acid:**

Amino acids profile of crayfish was determined according to A.O.A.C. (2012).

**Heavy metals content:**

Zink (Zn), Copper (Cu) and Lead (Pb) were estimated using atomic absorption spectrophotometer (A Perkin-Elmer, Model 2380.USA) according to the methods of Chapman and Pratt (1982).

**Physicochemical properties:**

**pH values and acidity values:**

pH values was determined as described by Jackson (1967), and acidity was determined as citric acid by titration with 0-1 N sodium hydroxide after adding a few drops of phenolphthalein as an indicator according to (A.O.A.C., 2002).

**Physical properties**

Water holding capacity (WHC) and plasticity (as indicator for tenderness) were measured as described by Volovinskaia and Merkooolova (1958).

**Texture Profile Analysis for untraditional crayfish burger:**

The texture profile of crayfish burger which included chewiness, gumminess, cohesiveness, and springiness were assessed using a texture analyzer TA-RT-KI (CT3 Texture Brookfield) at Central lab Faculty of Agriculture, Alexandria University according to Gomes *et al.*, (2006).

**Microbiological assay of raw crayfish and crayfish burger:**

Total bacterial count (TBC) were determined using nutrient agar according to method, described by Ragab (1997), Salmonella sp. determined according to Bryan (1991) and E. coli determined on macconkey agar according to Unlu"tu"rk and Turantas (1996).

**Sensory evaluation of untraditional crayfish burger:**

The sensory attributes covered by the taste panel by 15 person at the Food Industries Dept., Fac. of Agric., Mansoura University were appearance, color, flavor, taste, texture and overall acceptability according to (Paulus *et al.*, 1979).

**Statistical analysis:**

Statistical analysis was done using the statistical software package CoStat, (2005). All comparisons were first subjected to one way analysis of variance (ANOVA) and significant differences between treatment means were

determined using Duncan's multiple range test at  $p < 0.05$  as the level of the significance (Duncan, 1955).

**RESULTS AND DISCUSSION**

**Physical weight of crayfish:**

Physical weight of crayfish *Procambarus clarkii* which used in processing burger were determined and presented in Table (2) weight composition of tested red crayfish which were obtained from River Nile water the average weight of red crayfish as live weight was 26.7g. Data also shows that the total weight of inedible parts was about 22.78 g, being 85 % compared with edible part (tail meat) which recorded 3.98g (15%) of the live weight.

**Table 2. Weight composition of crayfish.**

Part	Weight (g)	Total weight %
Total weight	26.7	100
Total inedible parts	22.78	85
Tail meat	3.98	15

Yield of crayfish varied according to many factors temperature, feeding and season of capture. These results are in agreement with those obtained by El-Kholie *et al.*, (2012) and Hanaa and Mostsfa (1998) who found that weight of inedible parts was 84.64% of the live weight and Mona *et al.*, (2000) who reported that *P. clarkii* is heavily exploited as a fishery product and used widely in aquaculture. It is represented an important food source. The yield of its abdominal muscles ranges from 10 to 40% of the total body weight, depending on size, and maturity. Also, Zaitsev *et al.*, (1969) who reported that yield of red crayfish flesh varied considerably depending on species, period of intensive feeding, time of capture and amount of separated wastes.

**Chemical composition of raw crayfish and crayfish burger (on dry weight basis):**

The chemical composition of raw crayfish and crayfish burger of the River Nile on dry weight basis is presented in Table (3) we observed that moisture content of raw crayfish (78.1%) is higher than moisture content of crayfish burger (77.58%), this is due to addition of flour and corn flour this result is in agreement with Taşkaya *et al.*, (2003) who found that moisture content of fish fingers decreased during processing, and Ihm *et al.*, (1992) who stated that This deduction was due to the addition of some ingredients like wheat flour. Similar results have also been reported by for fish burgers produced from rainbow trout (*Oncorhynchus mykiss*).

**Table 3. Chemical composition of crayfish and crayfish burger on dry weight basis**

Samples Parameter	Raw crayfish	Crayfish burger
Moisture%	78.1	77.58
Crud protein%	81.13	60.27
Crud fat%	8.96	9.2
Ash%	7.03	15.94
Total carbohydrate%	2.88	14.59

In The present study, the percent of protein content was (60.27%) in crayfish burger and (81.3%) in raw crayfish. While, carbohydrate found as small amount in crayfish and crayfish burger, carbohydrates contents of crayfish burger were higher than those of raw crayfish sample, values were 14.59 and 2.88%, respectively this is due to addition of flour and corn flour in crayfish burger.

Raw crayfish meat has low fat content (8.96%) this low content of fat make it a good choice for the preparation of products. From the same Table we observed that fat and ash values increased in crayfish burger compared to fat and ash values in raw crayfish were (9.2 and 8.96) and (15.94 and 7.03), respectively. In the present study protein and moisture rates of crayfish burger were lower than the rates of crayfish as the raw material but increase in fat and ash rates was found in crayfish burger.

This result was in agreement with El-Sherif and Abd El-Ghafour(2015) who reported that fresh crayfish meat had moisture content 82.15%, protein 85.15%, fat 7.22%, ash 6.61% and carbohydrates 0.89%. Also, these find results are in accordance with those reported by Azad (2001) who found that the protein and moisture content in fish burger decreased and lipid and ash content increased, which is very similar with the present study.

**Heavy metals content of raw crayfish and crayfish burger**

Crayfish *Procambarus clarkii* pollution with heavy metals and its relationship to human health make it questionable as safe food for humans. Crayfish and crayfish burger content of Lead, Zinc and Copper presented in Table (4). Data in Table(4) revealed that heavy metals concentration level in crayfish arranged in descending order as follow Zink > Lead > Copper. With values 2.4, 0.53 and 0.51mg/100 g sample. While, heavy metals concentration level in crayfish burger arranged in descending order as follow Zink > Copper > Lead, with values 2.03, 0.44 and 0.42mg/100 g sample, respectively. Crayfish molt six times a year so it get rid of all the poisonous material that it absorbed which stored in the shell. These results were agreement with (Bagatto and Alikhan 1987) who reported that the content of Zinc in the body of a crayfish is naturally high. Also, these results were in permissible limit to FDA (1978).

It is clear to notice that concentration of heavy metals in water control in level of these metals in crayfish body. Heavy metals concentration in raw crayfish and crayfish burger Lead, Zinc and Copper were in the permissible limit which make it safe and clean as human food.

**Table 4. Heavy metal content of crayfish and crayfish burger (mg/100 g sample) on wet weight basis.**

samples	Raw	Crayfish
Heavy metal (mg/100 g sample)	crayfish	burger
Copper	0.51	0.44
Zinc	2.4	2.03
Lead	0.53	0.42

**Total nitrogen (T.N), non-protein nitrogen (N.P.N), protein nitrogen (P.N) and Total volatile nitrogen (T.V.N) of crayfish and crayfish burger:**

From Table (5) T.N values for crayfish and crayfish burger were 12.98 and 10.94mg/100g sample, respectively. While, N.P.N values were 0.75 and 0.59mg/100g sample, respectively. Numbers of non-protein nitrogenous compounds play a key role in metabolic process of marine animals and their spoilage. Also, PN values were 12.37 and 10.19 mg/100 g sample for crayfish and crayfish burger, respectively. Content of total nitrogen (T.N), non-protein nitrogen (N.P.N) and protein nitrogen (P.N) slightly decrease in crayfish burger compared to crayfish raw material.

While, T.V.N levels were 12.95 and 12.5 mg/100 g sample, for raw crayfish and crayfish burger, respectively. These results are in agreement with Hanaa and Mostafa (1998) who reported that values of T.N, NPN, PN and TVN were 13.72, 0.64, 13.08 and 13.72 mg/100gm, respectively.

**Table 5. Total nitrogen (TN), non-protein nitrogen (NPN), protein nitrogen (PN) and total volatile nitrogen (T.V.N) of crayfish and crayfish burger.**

samples	Raw	Crayfish
Parameter (mg/100g protein)	crayfish	burger
T.N	12.98	10.94
N.P.N	0.75	0.59
P.N	12.37	10.19
T.V.N mg/100g	12.95	12.5

T.N: Total nitrogen N.P.N: Non protein nitrogen  
P.N: Protein nitrogen T.V.N: Total volatile nitrogen

**Amino acids composition of raw crayfish and crayfish burger of River Nile:**

Data given in Table (6) shows the amino acids composition (mg/100g protein) of crayfish tail meat, compared with amino acid composition of crayfish burger. From the obtained data, we observed that total essential amino acids in raw crayfish were 46.61 % and total non-essential amino acids were 53.38%. While, total essential amino acids in crayfish burger were 44.55% and total non-essential amino acids were (55.44%). Also, it was clear that raw crayfish had the highest average levels of non-essential amino acids Aspartic (ASP), Serine (SER), Glutamic (GLU), Proline (PRO), Glycine (GLY), Alanine (ALA), Tyrosine (TYR) and Cysteine (CYS).

**Table 6. amino acids content of raw crayfish and crayfish burger as mg/100gprotein.**

Samples	Raw	Crayfish
Amino acids (mg/100 g protein)	crayfish	burger
Essential amino acids:		
Therionine (THR)	2.93	1.90
Valine (VAL)	3.67	2.13
Isoleucine (ILE)	3.16	2.16
Leucine (LEU)	5.33	3.77
Phenylalanine (PHE)	3.10	2.30
Histidine (HIS)	1.55	1.02
Lysine (LYS)	5.83	3.25
Arginine (ARG)	6.62	3.92
Methionine	ND	ND
Total of essential amino acids	32.19	20.45
E.A.A. %	46.61%	44.55%
Non-essential amino acids:		
Aspartic(ASP)	7.28	4.82
Serine (SER)	2.59	1.84
Glutamic (GLU)	11.00	8.08
Proline (PRO)	3.92	2.88
Glycine (GLY)	4.35	2.69
Alanine (ALA)	4.98	3.10
Tyrosine (TYR)	2.74	2.04
Cysteine (CYS)	ND	ND
Total of Non-essential amino acids:	36.86	25.45
Non E.A.A. %	53.38%	55.44%

ND: not detected. E.A.A.:Essential amino acids  
Non E.A.A.:Non-essential amino acids

Data presented in Table (6) shows that crayfish with highest content of Histidine (HIS) with 1.55mg/100g protein. On the other hand, leucine(LYS) content in raw crayfish and crayfish burger were 5.33 and 3.77 mg/100g protein, Isoleucine (ILE) were 3.16 and 2.16 mg/100g

protein and Valine (VAL) were 3.67 and 2.13 mg/100g protein, respectively, this results noticed that raw crayfish was highest branched chain amino acids (BCAA) Leucine, isoleucine, and valine content 5.33 and 3.16 mg/100g protein, respectively. From the same Table we observed that aromatic amino acids (Phenylalanine and Tyrosine) found in both crayfish and crayfish burger samples at concentration of 5.48 and 4.34 mg/100g protein, respectively.

Those results are in agreement with Ehigiatorand and Oterai (2012) who reported that the different amino acids in flesh of crustaceans species might be associated with the varying tastes as well as textural properties of meat of the crustaceans species.

**Physiochemical properties of crayfish and crayfish burger:**

From data obtained in Table (7) it could be illustrate that pH value of raw crayfish were 7.87. While, pH value of crayfish burger was 7.96. We observed that crayfish meat with high pH value this is may be due to values of pH for its environment. These results was in agreement with Mubarak,(1997) and Abd El-Monem,(2002) who noticed that The pH values at different sites along the River Nile of Egypt were always fluctuating between 7.2 and 9.2 under the effect of seasonal variations. Also, Atef and Mohamed (2014) who reported that pH value of crayfish tail was 7.44 and Huner (1988) who stated that it should be in the range of 7.2- 8.5.

From the same Table we observed that acidity values were 1.56 and 2.15 mg/100g for raw crayfish and crayfish burger, respectively.

**Table 7. Physiochemical properties of raw crayfish and crayfish burger**

samples Parameter	Raw crayfish	Crayfish burger
pH	7.87	7.96
Acidity(mg/100g)	1.56	2.15

**Physical properties of raw crayfish and crayfish burger:**

Results presented in Table (8) showed WHC of raw crayfish and crayfish burger. From obtained data, we observed that values of WHC of raw crayfish and crayfish burger were 4.85 and 4.17, respectively. Increase of WHC in crayfish burger may be due to starch influence. On the other hand, plasticity values were higher in crayfish burger compared with raw crayfish values were 4.32 and 3.14, respectively.

**Table 8. Water holding capacity (WHC) and plasticity of raw crayfish and crayfish burger:**

Samples Parameter (cm <sup>2</sup> /g)	Raw crayfish	Crayfish burger
WHC	4.85	4.17
Plasticity	3.14	4.32

**Texture profile analysis of crayfish burger**

Texture profile analysis considered one of the most important tests which performed to evaluate the quality of product that is because there is big relationship between texture profile analysis and sensory properties of the product and there for final acceptance for consumers.

Data presented in Table (9) obtained that texture analysis in crayfish burger at zero time were 0.61, 7.2 mm,16g and 1.1 mj for cohesiveness, springiness, gumminess and chewiness, respectively. From this result

we observe that crayfish burger high gumminess and chewiness. These results were in accordance with Rahman and Al-Mahrouqi, (2009) who stated that gumminess is defined as the product of hardness and cohesiveness. The higher gumminess arises from higher hardness value.

Our results was in agreement with Burey et al.,(2009) who stated that texture profile analysis (TPA) is a technique commonly used in industry for the evaluation of food textural behavior, as it can give an indication of sensory properties.

**Table 9. Texture profile analysis of crayfish burger**

Samples Parameter	Crayfish burger
Cohesiveness	0.61
Springiness	7.2 mm
Gumminess	16 g
Chewiness	1.1 mj

**Microbiological assay of raw crayfish and crayfish burger:**

Total bacterial count is an important criterion for quality evaluation are presented in Table (10) from obtained data we observed that count of total bacteria of raw crayfish ( $5.3 \times 10^3$  cfu/g) was higher than that of Crayfish burger ( $3.3 \times 10^3$  cfu/g) it may be due to white pepper because of antioxidant effect. These results are in accordance with Agbor et al. (2006) who reported that Pepper has antioxidant and radical scavengers.

**Table 10. Microbiological assay of raw crayfish and crayfish burger**

Microorganisms	Raw crayfish	Crayfish burger
Total bacterial count(T.B.C.)	$5.3 \times 10^3$	$3.3 \times 10^3$
<i>Salmonella sp.</i>	Nil	Nil
<i>E. coli</i>	Nil	Nil

The bacterial quality of final product depending on bacterial count of raw material, also good handling and preparation conditions affected in final product microbial quality.

A coliform bacterium is good indicator for hygiene and handling. The results of bacteriological study showed that the total bacterial load of both raw crayfish and crayfish burger were comparatively low. The ranges were within the acceptable limit. *E.coli* and *salmonella sp.* was not detected in both raw crayfish and crayfish burger samples. These data in contrast with El-Kholie et al.,(2012) who reported that count of *E. coli* and *Salmonella sp.* in raw crayfish tail meat were  $1.5 \times 10^2$  and  $2.4 \times 10^2$  respectively.

**Sensory evaluation of fish burger and crayfish burger:**

Data presented in Table (11) show the average score of sensory evaluation of crayfish burger compared to Fish burger, such as color, aroma, appearance, taste, texture and express their overall acceptability that are main factor of products quality. From Table (11) we observed that fish burger score in appearance (9.10), color (8.80), aroma (8.40), texture (7.80), taste (8.50) and overall acceptability (83.80%). While, crayfish burger has a very good score in appearance (9.2), color (8.90), aroma (8.20), texture (8.60), taste (8.20) and overall acceptability (85.00%) This range of products was developed using a variation of herbs and spices but keeping the textural attributes unaffected this high performance may be due to special taste of spices.

**Table 11. Sensory evaluation of crayfish burger**

Sensory properties Samples	Appearance	Color	Aroma	Texture	Taste	Overall acceptability	Average
Fish burger	9.10±1.101b	8.80±1.135b	8.40±1.776bc	7.80±1.549d	8.50±1.841b	83.80±17.974b	8.52
Crayfish burger	9.20±1.033 <sup>b</sup>	8.90±0.994 <sup>b</sup>	8.20±1.814 <sup>c</sup>	8.60±1.506 <sup>b</sup>	8.20±1.989 <sup>c</sup>	85.00±16.918 <sup>ab</sup>	8.62

Each value is a mean value of three replicates and is followed by the standard deviation.

Data bearing difference superscripts in the same column differ significantly.

Untraditional crayfish burger was actually evaluated as excellent. This indicates that crayfish burger was highly accepted for act as marketing product.

### CONCLUSION

In conclusion, results of this study increase the current knowledge about River Nile crayfish (*Procambarus clarkii*). These results provide important information for research on the health benefits of crayfish which evaluated as a new cheap source of protein we waste it. Also, it could be demonstrate that use of crayfish to produce a high nutritive and high quality burger.

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## إعداد برجر غير تقليدي من استاكوزا المياه العذبة

عبد الحميد إبراهيم عبد الجواد ، أحمد عزت قاسم ، جيهان عوض غنيم و سوزي محمد البحيري  
قسم الصناعات الغذائية – كلية الزراعة – جامعة المنصورة – المنصورة – جمهورية مصر العربية

الهدف من هذه الدراسة هو تقييم استاكوزا المياه العذبة وبرجر الاستاكوزا كمنتج غير تقليدي من حيث التركيب الكيميائي وخصائص الجودة كمصدر جديد وريخيص للبروتين الحيواني لسد الفجوة في نقص البروتين عن طريق استخدام استاكوزا المياه العذبة والتي تعتبر مصدر مهدر وغير مستخدم في مصر. تم عمل تقدير للخصائص الفيزيائية والكيميائية، و وجد ان الجزء المأكول في الاستاكوزا كان 3.15 جرام بنسبه (15%) من الوزن الكلى كما تحتوى الاستاكوزا على نسبة كبيره من البروتين 81.13% بينما كانت درجه الأس الهيدروجيني 7.87 ومن ناحيه اخرى سجل برجر الاستاكوزا نسبة بروتين 60.27% وكانت درجه الأس الهيدروجيني 7.96. وأظهر تحليل الاحماض الأمينية ان الاستاكوزا الطازجة وبرجر الاستاكوزا يحتويان على ثمانية أحماض امينيه أساسيه وسبعه أحماض أمينيه غير أساسيه . وكانت نسبة الاحماض الأمينية الأساسية 67.61% ونسبه الاحماض الأمينية الغير اساسيه 53.38% في الاستاكوزا ، بينما كانت نسبة الاحماض الأمينية الأساسية 44.55% ونسبه الاحماض الأمينية الغير اساسيه 55.44% في الاستاكوزا . وكذلك اظهرت الدراسة ان تركيز المعادن الثقيلة الرصاص والزنك والنحاس في كلا من الاستاكوزا وبرجر الاستاكوزا كانت في الحدود المسموح بها بينما كانت نسبة النيتروجين المتطاير الكلى 12.95 و 12.50 مجم / 100 جم بروتين لكلا من الاستاكوزا وبرجر الاستاكوزا على التوالي. وكانت قدره الاحتفاظ بالماء في البرجر اعلى منها في الاستاكوزا وكذلك اللدانة كانت اعلى في برجر الاستاكوزا عن الاستاكوزا الطازجة. و اظهرت نتائج اختبار تحليل القوام ان برجر الاستاكوزا كان مقبول كمنتج عالي الجودة. كما كان العدد الكلى للبكتيريا في الاستاكوزا الطازجة 3.10 × 10<sup>3</sup> اعلى منه في برجر الاستاكوزا 3.3 × 10<sup>3</sup> ولم يتم الكشف عن وجود أي من بكتيريا القولون او السالمونيلا. وايضا أظهر التقييم الحسي لبرجر الاستاكوزا ان درجه القبول الكلية للمنتج كانت 85.00 وان المنتج كان مقبول بدرجه كبيره كمنتج تسويقي.