مجلة علمية محكمة - ربع سنوية
Scientific Refereed Journal - Quarterly
South-South Dialogue

Production of broth cubes from microwave-dried meet and chicken and comparison with their commercial counterparts Submitted by

إنتاج مكعبات المرق من اللحم البقري والدجاج المجفف بالميكروويف ومقارنتها بنظيرتها التجارية

الباحثة / مروة أحمد بدوي أحمد

باحثة ماجستير تخصص (التغذية وعلوم الأطعمة) قسم الاقتصاد المنزلي

كلية التربية النوعية ، جامعه اسيوط

ا.د/ ناريمان سعيد اسحق

أستاذ التغذية وعلوم الأطعمة ووكيل الكلية لشئون الدراسات العليا والبحوث بكلية التربية النوعية

جامعة أسيوط

ا.د/ هبه عطية يسى

أستاذ الطب الشرعي والسموم الإكلينيكية

كليه الطب – جامعه أسيوط

المجلد السادس – العدد ٢١ – أبريل ٢٠٢٤

الترقيم الدولي

P-ISSN: 2535-2229 O - ISSN: 3009-6014

موقع المجلة عبر بنك المعرفة المصري https://hgg.journals.ekb.eg/

العنوان: كلية التربية النوعية – جامعة أسيوط – جمهورية مصر العربية

Add: Faculty of Specific Education-Nile street- Assiut
العنوان : كلية التربية النوعية –شارع النيل – أسيوط
Print ISSN: 2535-2229
On Line ISSN: 3009-6014
https://hgg.journals.ekb.eg
Office / Fax 088/2143535 فاكس / مباشر :
Tel 088/2143536 تليفون :
Mob 01027753777 موبايل :

Production of broth cubes from microwave-dried meet and chicken and comparison with their commercial counterparts

Abstract:

This study aimed to produce beef and chicken stock cubes and compare them with their commercial counterparts. It is prepared from chicken and beef dried in the home microwave, adding some healthy spices to it, and comparing the home product with commercial samples of cubed beef and chicken. The chemical composition was also verified, and the sensory evaluation was studied, as well as the effect of shelf life on the moisture percentage . The results obtained indicate that all homemade samples were higher in nutritional value compared to commercial samples. The percentage of protein in chicken and beef samples was (51.04%, 50.46%), respectively, and in commercial samples (7.33%, 7.75%), respectively. The commercial samples were higher in (moisture, ash, raw fat, and total carbohydrates) than the home-made samples. The results also indicated that there were statistically significant differences in sensory evaluation between the home and commercial samples in favor of the home sample. The results indicated a loss in the percentage of moisture in all samples during the specified period of 30 days, except for the commercial chicken broth cubes, which did not cause any loss in moisture during the aforementioned period. It showed that the yield of homemade products(1.2) and the number of serving was 6 pieces. The results showed a color change for the homemade samples during the storage period of (0,90) day. A color change was observed in the homemade samples from (dark brown and brown to light brown and yellow), respectively.

Key words: Microwave, beef, chicken, broth.

Introduction

Foods are organic substances which are consumed for nutritional purposes. Foods undergo spoilage due to microbial, chemical, or physical actions. Nutritional values, color, texture, and edibility of foods are susceptible to spoilage (Rahman., 2007). Food preservation is defined as the processes or techniques undertaken in order to maintain internal and external factors which may cause food spoilage. The principal objective of food preservation is to increase its shelf life retaining original nutritional values, color, texture, and flavor (Rahman., 2014).

Red meat is very important for nutrition thanks its protein, lipid, mineral, vitamin and bioactive contents. (Aykın and Erbas., 2014). Chicken meat is a substantial food for consumers all over the world. It is rich in essential amino acids and involves large amount of proteins (Cui et al., 2009). Chicken breast meat (a type of white meat) was selected because it has a lower fat content and is normally perceived as a healthier meat option by consumers.(Charlton et al., 2008). The chicken breast can be dehydrated and then is made into a famous natural seasoning (chicken powders) at home and abroad. Chicken powders can be healthy, delicious, and rich in nutritional ingredient (Ran et al., 2019).

Drying and dehydration Is the removal of water like volatile materials from the solid materials, for the aim of slowing the growth of microorganisms or chemical reactions (Radoiu., 2020). Drying extends the shelf-life of meat and meat products because of the reduction in water activity(Modi et al., 2007). In addition, the drying process reduces the microbial load and results in lighter volumes and weights, which decrease storage and transportation costs (Doymaz et al., 2016).

Drying meat and produce involves the simple process of exposing (Erbas and Aykın., 2016). Meat products are recognized as a highly perishable food with a limited shelf-life during processing, transportation, and storage. Meat should be subjected to preservation methods to increase its shelf-life (Modi et al., 2007). The main advantages of microwave drying are: i) short drying time, ii) more uniform heating) good energy efficiency (almost all electromagnetic energy is converted into heat) improved product quality, and v) flexibility in the production of a wide variety of products (Haghi and Amanifard., 2008 and Monteiro et al., 2015).

Microwave dried meat products have higher microbial quality as compared to dried by conventional methods as the

destruction of bacteria occurs by microwaves (Duan et al., 2011).

Broth is important for palatable dishes of various cuisines requiring broth. (Lee and Kim, 2015). the manufacturing process of the cubes consists in mixing ingredients (salt, monosodium glutamate, palm oil, caramel, spices such as soybean, locust bean gum, onion, tomato, natural proteins and starch), coloring and flavoring agents (Raw Materials Research and Development Council., 2003 and Rodrigues et al., 2016). The nutritional value of a food is related to the qualitative and quantitative composition of the nutrients present in it. Among these, both lipid fraction and sodium content have an enormous relevance because they play important roles on the maintenance of human health (Karsulínova et al., 2007).

Materials and Methods

Materials:

Beef meat was obtained from a local butcher in Assiut, Egypt. The fat of beef meat is extracted by the butcher. Chicken breast meat was purchased from a local market in Assiut, Egypt. Four chicken and beef stock products (CM) were obtained from the local grocery store (market, assiut , Egypt), and an online. All packaged samples were 10 g of stock cubes. All samples were kept in a dry and cool place.

Methods:

Preparation of homemade broth

A piece of red beef weighing 200 g was washed well and then cut with a sharp knife into pieces of dimensions (length * width * thickness) (1.5mm*1.5mm*.8mm) (Marlene., 2019). A piece of chicken breast meat weighing 210 g was washed well and then cut with a sharp knife into pieces of dimensions (length*width*thickness) (20mm*20mm *7mm) for the raw samples to protect its quality (Hii et al., 2014). After obtaining the meat and chicken powder, they are mixed with all the ingredients mentioned in (Table 1) and kneaded well and then formed into a cube shape as shown in the markets. The samples were placed in the dish and then dried using the microwave -assisted hot air drying method (Drying experiments were performed in a

microwave oven Bosch GmbH, Munich, (HMT72G420 model, Robert Bosch Hausgerate Germany), which has a maximum power output of 800 W working at 2450 MHz Siemens HB86K575, Germany) was set to a fixed air speed (1.0 m/s).

Table (1): The ingredients of homemade chicken and beef broth cubes.

The ingredients	Quantity (gm)
garlic powder	1.6
Ginger	0.5
Curry	0.75
Turmeric	1.25
Paprika	1
Clove	0.25
Cinnamon	0.1 5
Cardamom	0.15
Zaatar	0.15
laureate paper	1.5
onion powder	1.6
Coriander	0.25
parsley powder	0. 5
Iodized Salt	0.625
Caramel	0. 5
Cumin	0.375
black pepper	0. 5
lemon salt	1
Starch	1
Precise	2
Yeast	0.125
Corn oil	30ml
Low fat milk	30ml
Egg whites	5ml
Water	10ml

In this study, a meat and chicken cube was manufactured by mixing the ingredients of (Table 1). Natural spices and herbs were used instead of artificial colorings and monosodium glutamate to obtain the same color and flavor and to avoid health risks resulting

from the chemicals present in the commercial cube. Meat powder (beef and chicken) dried in the microwave was used instead of bone meal and meat flavor to increase the nutritional value of the cube. Use corn oil instead of palm oil. And low-fat liquid milk instead of powdered milk. And liquid egg whites instead of powdered egg whites. Then the dry ingredients were mixed together. Liquids were added (milk, water, egg whites, corn oil). He started mixing the ingredients together and getting a cohesive mixture. The mixture is cut into square shapes with known dimensions (cm2*cm2). The produced cubes were stored in a plastic container at room temperature until used for sensory evaluation and laboratory analysis, and the artificial preservatives were replaced by adding lemon salt as a natural preservative. All ingredients of the stock cubes (beef, chicken) are detailed in (Table 1).

Chemical analysis of chicken and beef broth cubes:

Moisture was determined according to the methods of AOAC (2000) by taking (3g) of sample in a pre-weighed porcelain crucible, which was dried to constant weight at 105°C for 14 hours. Loss in weight was taken as the moisture content of the sample. The protein was determined by Micro-Kjeldahl according to the methods of (AOAC, 2010), 1g of sample was placed in a digestion tube; 0.2g CuSO4, 1g K2SO4, and 20ml concentrated H2SO4 was added to the tube. The sample was let digested on digestion block until white fumes can be seen and continued heated for about 60 – 90 minutes until cleared with no charred material remaining. The tube was placed in the distillation apparatus and 50ml NaOH 32% was added. The ammonia in the sample was steam distilled for 5 minutes into a receiving flash containing 4% boric acid the sample was titrated with H2SO4 0.1N solution. The protein was calculated by the equation: %Nitrogen x 6.25. The crude fiber was determined with an enzymatic–gravimetric procedure according.

Crude fiber was ‹(to AOAC Method 991.43. (AOAC, 2010) determined following the approved method 962.09. Crude fiber is lost on ignition of dried residue remaining after digestion of the sample with 1.25% H2SO4 and 1.25% NaOH solutions under specific conditions. 2g of each sample was extracted with ether or petroleum ether and transferred to beakers of ceramic fiber mixture. Two beakers of ceramic fiber mixture for each sample were prepared as follows: 1.5 g dry weight of the sample was added to each 100 ml beaker, then 60-75 ml 0.255N H2SO4 was added to each beaker and allowed to soak. Beakers were placed on the digestion apparatus with a pre-adjusted hot plate and boiled for exactly 30 minutes. were filtered through a Buchner funnel (pre-

coated with ceramic fiber if extremely fine materials are being analyzed). Beaker was rinsed with 50-75 ml boiling H2O and washed through Buchner the funnel. The Residue was removed before 200 ml 1.25% NaOH was added and boiled for exactly 30 minutes. Contents were filtered and then washed with 25 ml boiling 1.25% H2SO4, 50 ml H2O and 25 ml alcohol. The residue was transfered to the ashing dish and dried for 2 hours at 130 ± 2o C Then, it was cooled in a desiccator and weighed. The residue was ignited for 30 minutes at 600 ± 15oC and cooled in a desiccator before being reweighed. % Crude fiber in ground sample = C = (Loss in weight on ignition loss in weight of ceramic fiber blank) x 100- weight sample AOAC (2010). Fat was determined by Soxhlet extractor according to AOAC (2010), 3g of sample with hexane using Soxhlet apparatus for 6 hours. The residual hexane was removed from the extracted sample by evaporation. The extracted fat was then dried and weighed and ash was determined according to the method of AOAC (2010), the crucibles containing5g of sample was charred on a heater before being kept in the muffle furnace at 550oC for 4 hours until only white matters can be seen. Then, the crucible with ash content was then cooled in a desiccator and weighed accurately to a constant weight.

All these analyses were determined in the Central Laboratory for Chemical Analysis, Faculty of Agriculture, Assiut University. The proximate analysis was carried out in triplicate to obtain a mean value for each nutrient. Carbohydrate content was calculated by difference. Total carbohydrates % = 100 - (moisture% + ash % +fat + % protein + % fiber content). Total calories were calculated using the equation: E = (2.62 × % protein) + (8.37 × % fat) + (4.2 × % carbohydrate) (Crisan and Sands., 1978). Where: E =Energy as calories per 100 grams sample.

Organ leptic evaluation of chicken and beef stock cubes:

Chicken and beef stock cubes were evaluated in terms of (color, taste, flavour, texture and appearance). All these attributes were evaluated by 50 persons (specialists in Nutrition and food science (30 persons) and ordinary consumers (20 persons)) on a hedonic scale ranging from 1 to 10 (1 is very bad and 10 for excellent) according to. (1 =dislike extremely, 2= dislike very much, 3= dislike moderately, 4 = dislike slightly, 5 = neither like a nor dislike, 6 = like slightly, 7 = like moderately, 8 = like very much and 9 = like extremely) according to (Watts et al ., 1989). Scores were collated and analyzed statistically.

Yield factor:

The calculated food productivity was calculated from the cooked ratio and the results were expressed in the number of servings of 100 grams of beef and chicken broth cubes and powder (Wendy et al., 2015).

Shelf life of beef and chicken broth cubes:

Shelf life in terms of moisture acquisition was conducted by storing the beef and chicken broth cubes at room temperature (30°C).The moisture content was determined beef and chicken broth cubes: (from initial known moisture content) every 15day.

Statistical analysis:

Data were presented as the mean of duplicate± standard deviation (mean ± SD). A test was used to establish the significance of differences among mean values at ($p< 0.05$). Analysis of variance (ANOVA) was carried out using Proc Mixed of SAS package version 9.2 (SAS, 2008) and means were compared by the Duncan test at a 5% level of significance (Steel and Trrie., 1981).

Results and Discussion:

From data presented in Table (2), showed the gross chemical composition of the commercial and home-made beef and chicken broth cubes. There were significant differences at ($P < 0.05$). (HM) beef broth cube was higher in moisture, crude fiber (28.60% ,0.912% respectively) than (CM) beef bouillon cube (1.37%,0.092%). It may be due to the ability of fibers to attract and absorb water (Chawla and Patil., 2010). These results are consistent with (Antonio et al., 2017). Also, HM beef broth cube was higher in crude protein content (6.60%) than beef broth cube (CM) (4.54%). The low protein content found in the samples, especially, This may be a result of the amount of protein source used in the broth formulation in the analyzed samples, the beef appeared only from the seventh ingredient (Antonio et al., 2017& Fatima., 2013).

However, the data showed that carbohydrate content(4.247%) and crude fat content (12.7%) were lower in (HM) beef bouillon cube than in CM content (18.7%,13.36%, respectively), They had a significant difference ($P<0.05$). The energy of the (CM) beef broth cube was higher in CM (212.6646

kA/cal) than the HM beef broth cube (142.0944 KA/cal) with a significant difference (P < 0.05). These results are in agreement with that reported by(Antonio., 2017). The results in Table (2) showed that there were significant differences (p≤0.05) between chicken broth cube (CM and HM) in protein content of chicken broth cubes (HM) and the protein content of commercial samples (CM). Protein content of (HM) was significantly higher than (CM), where (HM) recorded (51.04) protein, while (CM) recorded (7.33). This indicated that the chicken broth cubes are rich in protein.(Fatima, 2013) studied the protein content of mage cube (vegetable, chicken and beef) he found that the protein content of the chicken cube was the highest protein content (8.6%), vegetable cube had the lowest protein content (4.8%) on dry weight basis. From the same table it could be noticed that there were significant differences (p≤0.05) between chicken broth cube (CM and HM) in HM chicken broth cube was higher in moisture. The moisture loss or gain in foods is an important factor that alters the food qualities and organoleptic characteristics; therefore ,water retention is an essential component for maintaining food quality (Roudaut and Debeaufort., 2011), Crude fiber (25.19%, 2.32% respectively) than (CM) beef broth cube (0.19% , 0.12% respectively) with a significant difference (P < 0.05). While (Anderson et al., 2018)recorded different results. The results showed a difference in the percentage of fiber (25.9%), which is a higher percentage than shown here. Ash is a reflection of the total inorganic matter present in a good sample and it was ranged in chicken broth cubes (HM) and (CM) from (5.08,62.28% respectively) dry matter with a significant difference (P < 0.05) These results are in agreement with that reported by (Fatima, 2013).

The results showed there were significant differences (p≤0.05) between chicken broth cube (CM and HM) in Crude fat For samples (HM),(CM) were(11.6%,5.7% respectively) These results are in agreement with that reported by (Caponio et al., 2002). Crude fat in CM cubes (vegetable, chicken and beef) products and mushroom broth were found to be fairly high ranging between 2.9 to 4.7% respectively. Carbohydrates content of (HM) were significantly lower than (CM), where (HM) recorded (5.76), while (CM) recorded(25.38) (Fatima, 2013) also recorded an increase in the percentage of carbohydrates in the (CM) samples. The highest percentage of energy was recorded in commercial samples compared to home-made (121.30, 154.30 respectively).

Table (2) The chemical composition of the commercial and home-made beef and chicken broth cubes:

Sample	Moisture %	Ash %	Protein %	Crude Fat %	Crude Fiber %	Total carbohyd-rates %	Energy (kcal/) 100g
Chicken broth cubes (HM)	25.19 ±1.0	5.08 ± 1.0	51.04 ± 1.0	11.6 ± 1.0	1.326 ±1.0	5.76 ± 1.0	121.30± 1.0
Chicken broth cubes (CM)	0.19 ± 0.01	61.28 ±1.0	7.33 ±1.0	5.7 ± 1.0	0.119 ± 0.001	25.38 ± 1.0	154.31± 1.0
p.valuo	**	*	**	*	*	*	*
Meat broth cubes (CM)	1.37± 1.0	58.72 ± 1.0	7.75 ± 1.0	18.7 ± 1.0	0.092 ± 0.001	13.37 ± 1.0	212.66 ± 1.0
Meat broth cubes (HM)	28.60 ± 1.0	3.09 ± 1.0	50.46 ± 1.0	12.7 ± 1.0	0.913 ± 0.001	4.24 ± 1.0	142.09 ±1.0
p.valuo	**	*	**	*	*	*	*

Values are mean ± standard deviation. Means in the same column with different superscripts are significantly different ($p<0.05$).

The Organ leptic results from Table (3) revealed that there were significant differences ($p\leq0.05$) chicken and beef broth cube(CM,HM) in color/appearance, taste, mouth feel, flavor, consistency and overall acceptability. The highest mean score obtained for chicken and beef broth cubes (HM) (9.08, 8.82 respectively), while chicken and beef broth cube (CM) was (6.24, 5.42 respectively). There was significantly decrease in color/appearance, taste, mouth-feel, flavor, consistency and overall acceptability in (CM). The highest scores of chicken and beef broth cubes (HM) may be able to due probably to the high fat and

protein, compared to other (CM). The relatively lower mean scores of the chicken and beef broth cube(CM) are probably due to the small protein content and high salt content (Na Cl). All the broth cubes (HM) were still acceptable to the panelists as indicated by their mean score for overall acceptability .These results are consistent with (Fatima., 2013). Increase in meat flavor is caused by a greater activity of the Millard reaction and associated reacting in valuing muscle protein, carbohydrates and lipids and their degradation products (Ekanem and Solomon., 1997). Spices are known to enhance and improve the flavor and color of foods (Ekanem and Achirnewhu., 1998). They vary in their effects in that the aroma and flavor principles in spices are based on the essential contained in them. It would be assumed that the oils present in magi cube and some of the spices may have produced some modification of the flavor, taste and color thus making the meat samples generally accepted by the panelists (Fatima, 2013).

Table (3) Organ leptic evaluation for commercial (CM) and homemade (HM) beef and chicken broth cubes:

Samples	sensory properties					
	Appearan-ce (10)	Texture (10)	Color (10)	Taste (10)	Flavor (10)	Overall acceptabil it-y (10)
Chicken cubes (CM)	5.84 ± 1.0	5.94 ± 1.0	6.4 ± 1.0	6.06 ± 1.0	6.06 ± 1.0	6.24 ± 1.0
Chicken cubes (HM)	8.72 ± 1.0	8.46 ± 1.0	8.56 ± 1.0	8.68 ± 1.0	8.58 ± 0.577	9.08 ±1.0
p.valuo	*	*	*	*	*	*
Beef cubes (CM)	5.76 ± 1.0	6.28 ±1.0	6.08 ± 1.0	6.22 ± 1.0	5.8 ± 1.0	5.42 ± 1.258
Beef cubes (HM)	8.9 ± 1.0	9.02 ± 1.0	8.74 ± 1.0	8.66 ± 1.0	8.84 ± 1.0	8.82 ± 1.0
p.valuo	*	*	*	*	*	*

Values are mean ± standard deviation. Means in the same column with different superscripts are significantly different ($p<0.05$).

Table(4) showed that the yield of homemade products between Chicken broth cubes and beef broth cubes are Nan significantly. The results revealed that the yield factor in the home-made beef and chicken broth cubes was at isotropic (1.2), the number of serving was 6 pieces and the weight of the piece was 8 grams.

Table(4) Yield of homemade products beef and chicken broth cubes.

Description	Chicken broth cubes(8)g	beef broth cubes(8)g
Raw material (mg)	40.07 ±0.01	40.07 ±0.01
p.valuo	N.S	N.S
Factory products (mg)	48 ±1.0	48±1.0
p.valuo	N.S	N.S
Yield factor	1. 2 ±0.1	1.2 ±0.1
p.valuo	N.S	N.S
Number of servings	6 ±1.0	6±1.0
p.valuo	N.S	N.S

Values are mean ± standard deviation. Means in the same column with different superscripts are Nan significantly.

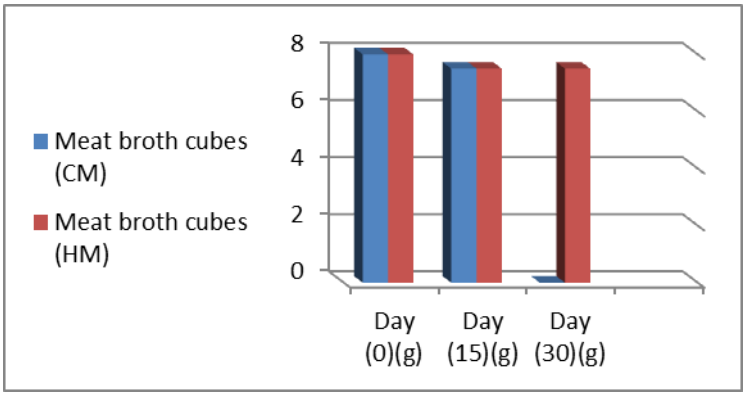
The results in Table (5) showed that there were significant differences ($p \leq 0.05$)betwen chicken and beef broth cube(CM,HM), the moisture content in the beef broth cubes (CM) high significantly decreased ($P<0.05$) at room temperature (30°C)(open). After 30 days, it became not edible These results are in agreement with that reported by(Steele, 2004) while beef broth cubes(HM) The rate of moisture loss was constant at (7.5 C) during (15 days

and 30 days), respectively .was noticed high significantly decreased (P<0.05) on Chicken broth cubes(HM) moisture content was (7.5g,7g) during (15 days and 30 days), respectively at room temperature (30°C) (open). This is consistent with (Yang-Ju Son., 2023) moisture is lost with the length of storage period, while Chicken broth cubes(CM)There was no loss of moisture content in it. These results are in agreement with those obtained by (Sandra et al., (2009) and Elizabeth and Judy., (2009). Adriana et al., (2012).

Table (5): Effect of shelf life on moisture content of commercial (CM)and homemade(HM) beef and Chicken broth cubes at the room temperature (30° C) (open).

Samples	Day(0) (g)	Day(15) (g)	Day(30) (g)
Chicken broth cubes(HM)	8 ±0.1	7.5 ±0.1	7 ±0.1
Chicken broth cubes(CM)	8 ±0.1	8 ±0.1	8 ±0.1
p.valuo	*	*	**
Meat broth cubes(CM)	8 ±0.1	7.5 ±0.1	Not edible
Meat broth cubes(HM)	8 ±0.1	7.5 ±0.1	7.5 ±0.1
p.valuo	*	*	**

Values are mean ± standard deviation. Means in the same column with different superscripts are significantly different (p<0.05).



Fig(1)

Conclusion:

Analysis of homemade beef and chicken stock cubes showed high moisture and protein content and low levels of dietary fiber, carbohydrates, fat and fixed mineral residues. There was also a difference in energy compared to those commercial samples. The shelf life of household samples was determined based on their moisture content, and the results showed a continuous decrease over the specified period. Through sensory evaluation, it was noted that consumers accept the home product more than the commercial product. The results also reinforce the importance of the consumer checking the nutritional composition mentioned on product labels. The results also showed the effect of shelf life on the shelf life in moisture loss. The loss was at a higher rate in samples of homemade chicken stock cubes compared to the foreign product. When monitoring the color change of the home-made samples during the storage period, a color change was observed in the home-made samples. The home microwave oven was used to dry samples of beef and chicken because it preserves the nutritional value of the foods and gives a better color compared to regular ovens.

REFERENCES

AOAC. (2010) : Official Methods of Analysis of Association of Official Analytical Chemists. 18th Edition, Washington, DC.

Anderson M. V., Sandra. M.L, Marlene. D,(2018) : Physicochemical characterization and comparison of labels of beef bouillon cubes
Food Science and Technology (Campinas) 38(1) DOI:10.1590/fst.11017

Antonio al. (2017) :Physicochemical characterization and comparison of labels of beef bouillon cubes DDOI: https://doi.org/10.1590/fst.11017.

Adjangba KM1*, Agbodji Y1, Agoro S1 and Amouzou EKS. (2020) : Cooking Salt Content in Food Cubes Commonly used in Northern Togo. Open Journal of Nutrition and Food Sciences2020 | Volume 2 | Article 1012058© 2020 - Medtext Publications. All Rights Reserved. ISSN 2690-2478Cooking Salt Content in Food Cubes Commonly used in Northern Togo.

Aykın E., Erbas M.(2016) : Quality properties and adsorption behavior of freeze-dried beef meat from the Biceps femoris and Semimembranosus muscles. Meat Sci. 2016;121:272–277. doi: 10.1016/j.meatsci.2016.06.030. [PubMed] [CrossRef] [Google Scholar].

Buket Er Demirhan, Burak Demirhan, Ceren Sönmez, Hilal Torul, Uğur Tamer
& Gülderen Yentür. (2015) : Monosodium glutamate in chicken and beef stock cubes using highperformance liquid chromatography, Food Additives & Contaminants: Part B, 8:1, 63-66, DOI: 10.1080/19393210.2014.991355 To link to this article: https://doi.org/10.1080/19393210.2014.991355.

Blum D(2012). Food that lasts forever, in TIME Magazine. 2012.

Boada L.D., Henríquez-Hernández L.A., and Luzardo O.P(2016): The impact of red and processed meat consumption on cancer and other health outcomes: epidemiological evidences. Food Chem. Toxicol. 92:236–244. doi:

10.1016/j.fct.2016.04.008 [PubMed] [CrossRef] [Google Scholar].

Caponio, F., T. Gomes and D. Delcuratolo, (2002) : Quantitative and qualitative characterization of the lipid fraction of bouillon cubes. European Food Res. and Tec., 215: 200-203

Charlton, K.E.; Probst, Y.C.; Tapsell, L.C.; Blackhall, P.J.(2008) :Food, Health and Nutrition: Where Does Chicken Fit?; Australian Chicken Meat Federation Inc.: North Sydney, Australia, 2008.

Chawla R. and Patil G. (2010): Soluble Dietary Fiber. https://doi.org/10.1111/j.1541-4337.

Crisan E. and Sands A. (1978): Nutrition value In: Biology and cultivation of
Edibles Mushrooms, edited by Chang ST and Hayes WA, New York, Academic
Press. Pp: 137-168.

Croitoru MD, Fülöp I, Kincses AM, Dudutz G, Craciun O, Dogaru MT.(2010) : Glutamate determination in foodstuffs with a very simple HPLC-UV method. Acta Alimentaria. 39:239–247.

Cui, C.; Zhou, X.; Zhao, M.; Yang, B.(2009) : Effect of Thermal Treatment on the Enzymatic Hydrolysis of Chicken Proteins. Innov. Food Sci. Emerg. Technol. 2009, 10, 37–41. DOI: 10.1016/j.ifset.2008.09.003.
Doymaz I., Karasu S., Baslar M.(2016) : Effects of infrared heating on drying kinetics, antioxidant activity, phenolic content, and color of jujube fruit. J. Food Meas. Charact. 2016;10:283–291. doi: 10.1007/s11694-016-9305-4. [CrossRef] [Google Scholar].

Duan Zhen-Hua., Jiang Li-Na Wang, Ju-Lan Yu Xiao-Yang. and Wang T. (2011) :Drying and quality characteristics of Tilapia fish fillets dried with hot air-microwave heating. Food and Bioproducts Processing. 89: 472-476.

Ekanem, E. O. and Solomon, I. P. (1997) :Chemical in the preservation and storage of selected animal food products. In Application of chemistry (I.O, Essien ed.), MEF publication Ltd. Uyo. Nigeria.

Ekanem, E. O. and Achinewhu, S. C. (1998) :Effects of spices application on microbiological quality and acceptance of West African clam meat processed by intermediate-moisture technology. Proc. Silver Jubilee Anniversary conference. O.Oduguwa, A.O Fanimo and O.A Osinowo (ed) Nig. Soc. Anim Prod.

Fatmagul MD, Osman I (2017) Investigation of the effect of a hybrid drying method on the color quality of nectarine slices and energy consumption. Stud U Babes-Bol Chemia LXII(1):237–248.

Fatima, M. (2013):Evaluation of mushrooms broth cube and its compared with Maggi broth cube products in Saudi Arabia. Journal of American Science, 2(5), 250–255.

Haghi, A. K., & Amanifard, N. (2008) :Analysis of heat and mass transfer during microwave drying of food products. Brazilian Journal of Chemical Engineering, 25(3), 491-501. http://dx.doi.org/10.1590/ S0104-66322008000300007

Karšulínová, L., Folprechtová, B., Doležal, M., Dostálová, J., & Velíšek, J. (2007) : Analysis of the lipid fractions of coffee creamers, cream aerosols, and bouillon cubes for their health risk associated constituents. Czech Journal of Food Sciences, 25(5), 257-264. http:// dx.doi.org/10.17221/679-CJFS. .

Klurfeld D.M.(2015) : Research gaps in evaluating the relationship of meat and health. Meat Sci. 109:86–95. doi: 10.1016/j.meatsci.2015.05.022 [PubMed] [CrossRef] [Google Scholar.

Lee, C., Lee, S., & Kim, K. (2015) :Use of consumer acceptability as a tool to determine the level of sodium reduction: A case study on beef soup substituted with potassium chloride and soy-sauce odor. Journal of Food Science, 80(11), S2570–S2576.

Modi V.K., Sachindra N.M., Nagegowda P., Mahendrakar N.S., Narasimha Rao D.(2007) :Quality changes during the storage of dehydrated chicken kebab mix. Int. J.

FoodSciTechnol. 2007;42:827–835doi: 10.1111/j.1365-2621.2007.01291.x [CrossRef] [Google Scholar

Monteiro, R. L., Carciofi, B. A. M., Marsaioli, A. Jr, & Laurindo, J. B. (2015) : How to make a microwave vacuum dryer with turntable. Journal of Food Engineering, 166, 276-284. http://dx.doi.org/10.1016/j. jfoodeng.2015.06.029.

Populin T, Moret S, Truant S, Conte LS.(2007) : A survey on the presence of free glutamic acid in foodstuffs, with and without added monosodium glutamate. Food Chem. 104:1712–1717 62/ Skurray GR, Pucar N. 1988. L-glutamic acid content of fresh and processed food. Food Chem. 27:177–180.

Radoiu Marilena. (2020) : Microwave drying process scale-up155:108088 Chemical Engineering and Processing - Process Intensification https://www.researchgate.net/publication/343519376_Microwave_drying_process_scale-up. DOI:10.1016/j.cep.2020.108088

Ran, X. L., Zhang, M., Wang, Y., & Liu, Y. (2019) : A comparative study of three drying methods on drying time and physicochemical properties of chicken powder. DryingTechnology,37(3),373- 386

https://doi.org/10.1080/07373937.2018.1458734, [Google Scholar]

Rahman MS (eds).(2007) : Handbook of food preservation. 2nd ed. Food sci-ence and technology. Boca Raton: CRC Press; 2007. Rahman.R.(2014):Food preservation.

http://en.banglapedia.org/index.php?title=Food_Preservation

Raw Materials Research and Development Council – RMRDC. (2003, December) : Multi-disciplinary committee report of the techno-economic survey of food, beverage and tobacco sector - 4 Update. Nigeria:Federal Ministry of Science and Technology Abuja.

Rodrigues, É. D. F., Pantoja, L. D. A., Soares, M. B., Nelson, D. L., & Santos, A. S. D. (2016) : Development of bouillon cubes from souari nut pulp:formulation and physicochemical and sensorial evaluations. Brazilian Journal of Food Technology, 19(0), 1-8. http:// dx.doi.org/10.1590/1981-6723.5415

Rossi, D. M.; Fl^ores, S. H.; Heck, J. X.; Ayub, M. A. Z.(2009) : Production of High-Protein Hydrolysate from Poultry Industry

Residue and Their Molecular Profiles. Food Biotechnol. 2009, 23, 229–242. DOI: 10.1080/08905430903102828.

Roudaut, G.; Debeaufort, F.(2011) : Moisture loss, gain and migration in foods. In Food and Beverage Stability and Shelf Life; Kilcast, D., Subramaniam, P., Eds.; Woodhead Publishing: Sawston, UK, 2011; pp. 63–105

SAS. (2008) : Static Analysis, 15th International Symposium, Valencia, Spain, Proceedings. Lecture Notes in Computer Science 5079, ISBN 978-3-540-69163-1

Steel R. and Torrie J. (1980): Principles and Procedures of Statistics. 2nd Ed. New York: McGraw-Hill.

Steele R. Understanding and measuring the shelf-life of food, 1st ed. Woodhead Publishing Limited; 2004.

Watts B., Ylimaki G., Jeffery L., and Elias, L. (1989): IDRC-277e. Basic sensory methods for food evaluation. Ottawa, Ont., UOC: 664.001.5:339.4 ISBN: 0-88936-563-6.

Wendy et al ,2015 BCCooArticulation Committee. (2015) : Basic kitchen and food service Management. Victoria B.C retrieved from http://opentextbc.ca/basick.

Yang-Ju Son(2023) : The Physical, Sensory, and Microbial Qualities of Broth Gels Enclosing Food Cubes and Their Changes during Cold Storage Processes 11(8):2327 DOI:10.3390/pr11082327 LicenseCC BY 4.0.

إنتاج مكعبات المرق من اللحم البقري والدجاج المجفف بالميكروويف ومقارنتها بنظيرتها التجارية

مستخلص البحث:

هدفت هذه الدراسة إلى إنتاج مكعبات مرقة اللحم البقري والدجاج ومقارنتها مع نظيراتها التجارية. يتم تحضيره من الدجاج ولحم البقر المجفف في الميكروويف المنزلي، مع إضافة بعض البهارات الصحية إليه، ومقارنة المنتج المنزلي مع العينات التجارية من مكعبات اللحم البقري والدجاج. كما تم التحقق من التركيب الكيميائي ودراسة التقييم الحسي وكذلك تأثير مدة الصلاحية على نسبة الرطوبة. وتشير النتائج التي تم الحصول عليها إلى أن جميع العينات محلية الصنع كانت أعلى في القيمة الغذائية مقارنة بالعينات التجارية. بلغت نسبة البروتين في عينات الدجاج ولحم البقر (٥١,٠٤%، ٥٠,٤٦%) على التوالي، وفي العينات التجارية (٧,٣٣%، ٧,٧٥%) على التوالي. وكانت العينات التجارية أعلى في (الرطوبة والرماد والدهون الخام والكربوهيدرات الكلية) من العينات محلية الصنع. كما أشارت النتائج إلى وجود فروق ذات دلالة إحصائية في التقييم الحسي بين العينة المنزلية والتجارية لصالح العينة المنزلية. أشارت النتائج إلى فقدان في نسبة الرطوبة في جميع العينات خلال الفترة المحددة بـ ٣٠ يوما باستثناء مكعبات مرق الدجاج التجارية التي لم تسبب أي فقدان في الرطوبة خلال الفترة المذكورة. وأظهرت أن محصول المنتجات محلية الصنع (١,٢) وكان عدد الحصص ٦ قطع. واظهرت النتائج التغير اللون للعينات محلية الصنع خلال فتره التخزين من (٠،٩٠) يوم لوحظ تغير اللون في العينات محلية الصنع (اللحم البقري والدجاج) من اللون (البني الغامق والبني وصولا للون البني الفاتح والاصفر) علي التوالي.

الكلمات المفتاحية: الميكروويف، لحم البقر، الدجاج، المرق.