

Evaluation kernel fruits content of some *Terminalia* species cultivated in Egypt

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ABSTRACT

This work evaluation kernels of *Terminalia bellirica* and *Terminalia arjuna* covered with chocolate and applied to commercially available peanuts wrapped in chocolate, the taste and sensory qualities were assessed. *T. bellirica* kernels recorded a high percentage of protein and oil (27.5±0.03 and 34±2.00 %) respectively compared to *T. arjuna*. On this concern, fatty acid composition percentage of *Terminalia* sp. compared to commercial olive oil. *T. bellirica* and *T. arjuna* kernels showed that higher palmitic acid content (22.58 and 21.04%) respectively compared to olives oil, Palmitoleic acid mono-unsaturated is an omega-7 compared to *T. bellirica* kernels and olive oil and stearic contained (8.77 and 5.76 %) respectively compared to olives oil (2.37%). *Terminalia* sp. had content omega-3 addition enhanced than olive oil of linoleic acid and omega-6 percentage. Moreover, complete amino acids are abundant in kernels content. The most common amino acid was glutamic acid, which was followed by arginine and serine for *T. bellirica* and *T. arjuna* kernels flour content (28.8 and 23.04 g/16gN) respectively of total essential amino acids. *T. arjuna* kernels enhanced content Ca, Mg and K. *T. bellirica* and *T. arjuna* also contained (0.145 ± 0.10 and 0.110±0.08 mg), (0.351 ± 0.01 and 0.293±0.02 mg), (0.792 ± 0.09 and 1.030±0.03 mg) and (1.450 ± 0.02 and 0.952±0.02 mg) per 100g of kernel, respectively, of vitamins B1, B2, C, and A. The results showed that Terminalia kernels coated with chocolate are more nutritious highly acceptable healthy food.

Keywords: *Terminalia bellirica* and *Terminalia Arjuna*, kernels contents, fatty and amino acids

INTRODUCTION

Terminalia genus, Fam. Combretaceae, Angiosperms class. Terminalia is large tree, fast-growing evergreen, grown nearly 30m high and the diameter is about 3 m and looks like a rounded crown. It is customarily buttressed trunk near the base, and branchless is more than 5 m long. *T. bellirica* classify trees as species of the genus Combretaceae, which belongs to the Combretaceae family (Jayakumar 2019). In India, it's called "Bahera," and had used in Ayurveda (Namasivayam *et al.*, 2021). Most developed countries still rely on tree-based nutrition and public medicine for primary care (Oeba and Illiassou 2020). Santos *et al.* (2016) been observed that fruit of the Terminalia has been used as a nutritional supplement or as an ingredient in food items. Akter *et al.* (2018) showed that *T. ferdinandiana* kernels were a high minerals K 6693 mg, Ca 5385 mg and Fe 61 mg, as well as Zn 60 mg were abundant added to other poor metals. On the other hand, fatty acid structure of the seed consisted of omega-6 fatty acid, linoleic acid (50.2%), monounsaturated oleic acid (29.3%) and twice saturated fatty acids palmitic acid (12.0%) and stearic acid (7.2%). The results investigated that *T. ferdinandiana* nuts have the ability to be used in a variety of ways, it has an excellent protein source for dietary purposes and untraditional supply of linoleic and oleic as well as palmitic acids. Zhong *et al.* (2018) shown that *T. cunninghamii* kernels were much higher than common Mg and Zn.

This study observed a lot of ability for long-period use of nuts as an excellent nutritious and stuff that is good for human health. Mojarradgandoukmolla *et al.* (2021) found that fed rabbits on *T. arjuna* showed a considerable reduction in total cholesterol and low-density lipoprotein in comparison to the control. Arjuna ksheerpaka is a milk extract used since ancient times as a public food. It possesses an excellent nutritive value. Arjuna ksheerpaka is the best acceptable for healthy individuals because it has the main important content lipids, vitamins, fatty acids, proteins, minerals and enzymes added minerals are all ingredients (Chatha *et al.*, 2014). On this concern, yagbhatta bark of *T. arjuna* with milk recommended heart tonic in various cardiac problems to administer as a decoction with milk every morning in empty stomach for a long period of about a year all cardiac problems are said to be cured Tripathi *et al.* (1996). Ayurveda is a medicinal formula that combines the extracted seeds of *T. bellirica* known as "Triphala" had used as a nutritional and dietary supplement for a variety of health effects, including detoxification, liver safety, anti-ageing, and body rejuvenation. Ponnusankar *et al.* (2011) and Mukherjee *et al.* (2006). The main objective of the present research paper is to investigate a conventional formulation nutrition value of *Terminalia* in addition to estimating the taste and odder kernel of *T. arjuna* and *T. bellirica* coated with chocolate compared with peanuts.

MATERIALS AND METHODS:

Pharmacognostical studies:

The basis of their morphology, macroscopic and microscopic characters It referred to evaluate kernel fruits of *T. arjuna* and *T. bellirica* by color, odor, taste, size.

Plant material:

Ripe seeds had collected in healthy condition in June of *T. arjuna* and *T. bellirica* in the 2016 season from the Giza Zoo garden and Alzohria garden, Cairo, Egypt. Seeds had rinsed with running tap water. Till all the foreign material and soil particles detached from the seed surface. Afterwards shade-dried open air at room temperature. The kernel fruits had manually separated and finely powdered by utilizing an electric grinder and separately.

Phytochemical analysis:

In this study, preliminary phytochemical screening had operated on the ethanol kernel seeds extracts according to standard methods (Chitravadivu *et al.*, 2009). The contents of moisture, protein, crude fibres, and ash were determined using the method listed in by Horwitz (2010). Total sugar had assessed using the difference between types based on Horwitz (2010).

Soxhlet extraction:

Terminalia sp. kernels ground had placed into each thimble for soxhlet extraction. Ethanol solvent ratios had used 150 ml. This process had carried out by retching each on water glass beaker with 6 hours. The solvents were evaporated using a rotary evaporator after the time had passed.. Then the samples had collected and preserved in sealed bottles at -20°C for further analysis.

Oil yield calculation:

The oil extracted by soxhlet extraction was then calculated for ethanol extraction solvent. An oil extracted was expressed as a percentage of total mass, then had formulated with the Equation below (Fauzi *et al.*, 2011).

$$\text{Oil yield \%} = \frac{\text{mass of extract (g)}}{\text{mass of sample (g)}} \times 100 \%$$

Mineral material composition:

Material of mineral structure K, Mg, Ca, Fe, Zn, and Mn of kernels of terminal spp separately powders had determined according to Horwitz (2010). Wet acid digestion was performed on the samples of kernels according to the procedure defined by Bhandari and Lucas (2018). The amounts of Fe, Zn, and Mn in kernels sample that has been digested then ascertained by G.B.C. Atomic Absorption 906A by Horwitz (2010). Flame photometer 410 was used to evaluate K. Ca and Mn had Two Beam Atomic Absorption was used to determine.

Determination vitamins:

Vitamin A content using HPLC analysis between 450 and 290 nm lengths respectively Oliver and Palou (2000). Water extract vitamins B1 at wave 360nm addition Vitamin C and B2 have a length of 254 nm and 510 nm (Sami *et al.*, 2014).

Determinate fatty acid:

The oil had extracted by using the analyzed method described by Kowalska *et al.* (2003). The fatty acid structure had described by using gas-liquid chromatography. (GLC). Benzene, methanol, and acetone were used to make methyl esters of lipids and The methylation method had obtained in one hour around 80-90°C using sulfuric acid 86: 10: The Apye Uvicom PU 4550 detector for dual-flame ionisation was used. An extraction for lipids methyl ester had carried out by utilizing a column of 1.5 x 4 mm wrapped glass lined with cardiology 120 tangle with potted on 10% polyethylene glycol. The thermal of the oven had adapted with 8°C. at 70°C to 190°C after that isothermal with 190°C. The rotational speeds for hydrogen plus air became 320 ml/min of nitrogen also as gas phase at 30 ml/min. The temperatures detector of injectors were 300°C and 250°C, respectively. The fat chromatogram was used to determine the residence time of the uncertain fatty acids. The lipid had determined with normalizing with a component of reply analyzed utilization PU 4810 rivalry in incorporation. A lipid structure had as a proportion of the overall fat (Frag *et al.*, 1984).

Amino acid determination:

The amino acid of Terminalia kernels 6N HCl was used to acid hydrolyzes the samples. The hydrolyzate had been extracted by evaporating the acid in a rotary vacuum evaporator. Proteins were measured in a protein hydrolysate using an amino acid detector, the LC 3000 amino acid scanner, a tool of LC Biochrom EPPDROP (Horwitz 2010).

Preparation of *Terminalia* sp. kernels covered with chocolate:

Terminalia spp. kernels were soaked in water and oven-dried after that chocolate encrusted.

Sensory evaluation:

The organoleptic characteristics of were assessed on *Terminalia* sp. kernels chocolate-covered peanuts vs. chocolate-coated peanut, commercial name (S & S) according to Carpenter (2000).

Analytical statistics:

The information had as a mean value of a standard deviation (SD) of five plicate determinations. One-way measurement of variance (ANOVA) was used to analyze the statistical study. SPSS version 17. Low significant degree at (0.05).

RESULTS:**Kernels characters:**

Table (1) showed that *T. bellirica* was heavier than *T. arjuna* kernel, while *T. arjuna* and *T. bellirica* were lanceolate and spherical respectively. Odor and taste of *T. bellirica* are more agreeable than *T. arjuna*.

Table1: Some physical kernel characters of *Terminalia spp.*

Characters	Ripe Kernel fruits	
	<i>T. arjuna</i>	<i>T. bellirica</i>
Color	Dark brown	Bright brown
Odor	Mild earthy	Mild earthy
Taste	little acid	sweet
Size	Small	medium
Length	1-2 cm	2-3 cm
weight	1-1.5 g	2-3 g

Chemical Composition:

The chemical composition of kernels. *T. arjuna* more moisture content than *T. bellirica*. Meanwhile kernels have (20.5±0.05 - 27.5±0.03 %) protein on two terminalia sp. *T. bellirica* recorded higher oil percentage compared to *T. arjuna*. Meanwhile, *T. bellirica* and *T. arjuna* have (2.42±0.12– 2.87±0.13%) on ash respectively. On other hand, *T. bellirica* had (6.35±0.30) fiber percentage as shown in **Table (2)**.

Table 2: Chemical composition of *Terminalia* kernels

Chemical component (%)	<i>T. arjuna</i>	<i>T. bellirica</i>
Moisture	5.32±0.30	4.85±0.28
Protein	20.5±0.05	27.5±0.03
Oil	22±3.00	34±2.00
Ash	2.42±0.12	2.87±0.13
Fiber	3.50±0.50	6.35±0.30

Fatty acid percentage of *Terminalia* sp.

Fatty acid compositions of *Terminalia* sp. kernels Figures (1 and 2) compared to olive oil had shown in **Table (3)**. Palmitic a saturated acid (C16:0) percentage of *T. bellirica* and *T. arjuna* kernels recorded (22.58 and 21.04%) respectively compared to (13.30%) in olives oil content. Data observed *T. arjuna* kernels had the best contained palmitoleic acid monounsaturated is an omega7 compared to *T. bellirica* kernels and olives oil. In addition, kernels of *T. bellirica* and *T. arjuna* contained (8.77 and 5.76 %) respectively compared to olive oil (2.37%) of stearic saturated fatty. Oleic is a monounsaturated acid olives oil had (70.13%) compared to *T. bellirica* and *T. arjuna* (28.21 and 24.35 %). Meanwhile *T. bellirica* and *T. arjuna* more increment than olives oil of linoleic acid percentage. On the other hand, *T. bellirica* and *T. arjuna* had omega-6 is polyunsaturated acid compared to olives oil. Therefore, olives oil had (0.79%) compared to *T. bellirica* and *T. arjuna* (0.16 and 0.10%) of omega3 content.

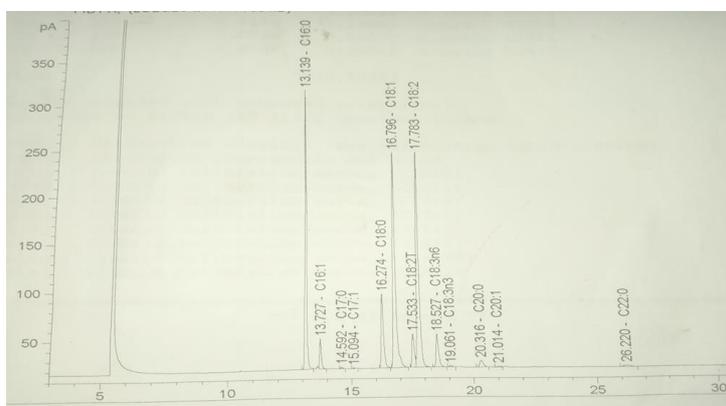


Fig. 1. *T. bellirica* kernels of fatty acid composition content.

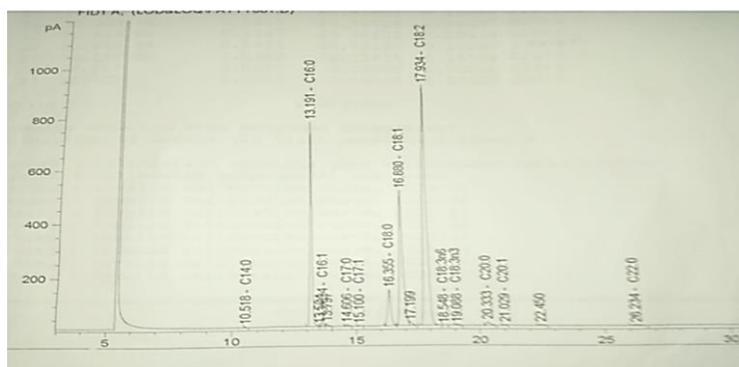


Fig. 2. *T. arjuna* kernels of fatty acid composition content.

Table 3: Fatty acid percentage of *Terminalia* sp. and marketing Egypt olive oil.

Fatty acid %	<i>T. bellirica</i>	<i>T. arjuna</i>	olive oil Bhnsawy <i>et al.</i> (2017)
Myristic acid	-	0.05	0.01
Palmitic acid	22.58	21.04	13.30
Palmitoleic acid (C16:(1n7) omega7)	-	0.19	-
Palmioloic (zoomaric acid) (C16:1)	2.54	0.56	0.67
Margaric (C17:0)	0.15	0.14	0.05
Heptadecenoic acid (C17:1)	0.06	0.03	0.1
Stearic (C18:0)	8.77	5.76	2.37
Oleum (oleic) (C18:1)	28.21	24.35	70.12
Linolelaidic acid (C18: 2T)	3.86	0.47	0.07
Linoleic acid (C18:2)	27.58	46.19	11.44
Omega-6 polyunsaturated fatty acid (PUFA) (C18:3 (n6))	4.22	0.30	-
Omega-3	0.16	0.10	0.79
Arachidic	1.17	0.58	0.46
Eicosenoic (C20:1)	0.16	0.10	0.44
Arachidonic acid (C20:4)	-	0.17	-
Behenic (C22:0)	0.53	0.16	0.14

Mineral Composition:

Compositions of the elements of *Terminalia* kernels were described in [Table \(4\)](#). The inorganic mineral components of the ash in this study were Mg, K and Ca. *T. arjuna* and *T. bellirica* samples. Among the trace elements *T. arjuna* kernel more capable than *T. bellirica*.

Table 4: Mineral content of *T. arjuna* and *T. bellirica* kernels (ppm)

Mineral	<i>T. arjuna</i>	<i>T. bellirica</i>
K	165.00± 6.90	156.86± 0.024
Mg	455.32± 1.60	415.63± 0.097
Ca	944.34± 0.03	723.51± 0.010
Mn	9.40± 0.05	2.711± 0.000
Fe	15.00± 0.03	3.155± 0.041
Zn	9.00± 0.05	1.342± 0.0013

Terminalia sp. kernels amino acids content:

The structure of amino acids in *Terminalia* kernels flour is shown in [Table \(5\)](#) The most common amino acid was glutamic acid, which was followed by arginine and serine for *T. bellirica* and *T. arjuna* respectively. Thereby, the *T. arjuna* kernel more enhanced content of β -alanine, glutamine and ornithine compare to *T. bellirica*. On the other side, *T. bellirica* and *T. arjuna* kernels flour content (28.8 and 23.04 g/16gN) respectively of total essential amino acids

Table 5: Amino acid for *T. bellirica* and *T. arjuna* kernels composition content.

Amino acid (g/16gN)	<i>T. bellirica</i>	<i>T. arjuna</i>
Non-essential amino acids		
Arginine	17.50	9.56
Alanine	3.75	1.03
Aspartic	7.06	4.22
Glycine	6.22	2.50
Glutamic	25.00	20.30
Proline	5.26	10.60
Serine	3.44	15.50
β-Alanine	-	0.56
Glutamine	-	4.12
Ornithine	-	1.02
Asparagine	-	5.32
Essential amino acids		
Cystine	-	0.32
Histidine	2.42	2.60
Iso leucine	3.46	3.00
Lysine	3.22	3.50
Methionine	0.72	-
Phenylalamine	3.25	2.1
Tyrosine	2.07	2.00
Threonine	2.04	3.40
Tryptophan	0.86	0.52
Valine	3.81	2.80
Leucine.	6.95	5.2

Terminalia sp. kernels vitamin content:

The investigated data showed *T. bellirica* kernels more enhanced thiamine compared to *T. arjuna* kernels content (0.145 ± 0.10 and 0.110 ± 0.08) respectively. On this concern riboflavin kernels of *T. bellirica* increment *T. arjuna* kernels. *T. bellirica* kernels more capable than *T. arjuna* kernels retinol content (1.450 ± 0.02 and 0.952 ± 0.02) respectively. On the other hand, *T. arjuna* kernels recorded higher ascorbic acid content compared to *T. bellirica* kernels [Table\(6\)](#).

Table 6: Vitamin compositions of Terminalia sp kernels.

Vitamin	<i>T. bellirica</i>	<i>T. arjuna</i>
	Concentration (mg/100g)	
Thiamine (B1)	0.145 ± 0.10	0.110 ± 0.08
Riboflavin (B2)	0.351 ± 0.01	0.293 ± 0.02
Retinol (A)	1.450 ± 0.02	0.952 ± 0.02
Ascorbic Acid (C)	0.792 ± 0.09	1.030 ± 0.03

Sensory evaluation of terminalia sp kernels covered for chocolate:

According [Table \(7\)](#) the sensory test, kernels of terminalia sp. coated with chocolate prepared from *T. bellirica* and *T. arjuna* kernels were more palatable with the finest flavor and color, odder as well as over liking compared with commercial peanut chocolate named S & S Kernels of terminalia sp. coated with chocolate had significantly enhanced taste, colour, odder and over liking acceptability.

Table 7: Sensory evaluation of terminalia sp. kernels coated with chocolate compered to peanut

Character	<i>T. bellirica</i>	<i>T. arjuna</i>	Peanut seed
Taste	9.60 ± 1.00 a	9.00 ± 1.00 a	7.00 ± 0.94 b
Colour	9.20 ± 0.90 a	9.00 ± 1.00 a	8.90 ± 0.71 b
Odder	9.00 ± 0.82 a	8.60 ± 1.00 a	7.00 ± 0.80 b
Over liking	9.00 ± 0.95 a	8.60 ± 1.00 a	7.50 ± 0.85 b

DISCUSSION

The objective of this investigate paper spotlight the conventional formulation nutrition value furthermore evaluated taste and odder kernel fruits of *T. arjuna* and *T. bellirica* covered with chocolate compared with peanuts. On this concern, Yoganasimhan (2000) reported that *T. bellirica* kernels had sweet and smell odor oil. Abraham et al. (2014) and Saraswathi et al. (2012). Further, Yoganasimhan (2000) reported that *T. arjuna* fruits acrid and sweet.

The preceding studied showed that *T. arjuna* and *T. bellirica* seed kernels contain oil, protein, and fiber. Chakradhari et al. (2019). *T. bellirica* kernels can currently, it's being used to food. It had the content of 40% fatty acid and 35% amino acid. Protein is a requirement It is the source of all nutrition, and life will be impossible without it. The protein rich content is essential because it exists as a source of food protein, especially for people with hypertension. Akpakpan and Akpabio (2012) recommended for kids aged 1–10, a maximum protein consumption of 0.88 g/kg bodyweight. Das et al. (2019) investigated that terminalia sp seed with 3.95% dampness and 3.94% fiber.

Rukmini and Rao (1986) reported that oil extracted from *T. bellirica* kernels had oleic acid (24%), palmitic acid (35%) and linoleic (31%) acids are the three main fatty acids content. It recommended that using oil for human diet edible consumption purposes because it considered the best source of linoleic acid. Das et al. (2019). As well as, it had observed that terminalia sp. recorded higher immersed greasy acids, particularly oleic and linoleic. Weerawatanakorn (2015) *T. catappa* kernels had oleic acid (C18:1) The major fatty acids, which accounted for 32.4%. The composition of saturated, monounsaturated, and polyunsaturated fatty acids was similar to that prescribed by the Heart Association Organization nutritional recommendations. Monnet et al. (2012) investigated Palmitic acid (37.26%) was perhaps the most concentrated fatty acid on *T. catappa* kernels, followed with oleic (32.40%) and linoleic acids (24.65%), by stearic (5.55%), linolenic (0.55%), palmitoleic (0.41%), myristic (0.17%), and lauric (trace) acids coming in second and last, respectively. On this concern The disparities in results may be attributed to a combination of genetic factors that influence lipid content. Mehran and Filsoof (1974); Canellas (1986); Amaral et al. (2006); Venkatachalam and Sathe (2006).

In addition to this data, Hasadsri et al. (2013) observed that omega-3 after brain injury in humans, it was discovered to recover neuronal functions, minimise oxidative stress, heal synaptic harm, and reduce the activation of angiogenesis processes. Patterson (2012) conclusion that unbalanced dietary consumption of converting omega-6 into omega-3 polyunsaturated effects of diet supplemented of lipids enhanced public health. Omega-3 polyunsaturated fatty acids inflammatory infections are alleviated. García et al. (2017) omega-7 monounsaturated fatty acid had adjuvant decrease inflammatory.

Results agreeable as macro-and micronutrients and trace elements seed kernels' (K, Mg, Ca, Mn, Fe, and Zn) contents ranged around (1754 - 65521 - 2150 - 51100 - 63 -42300 mg/kg) respectively. Chakradhari et al. (2019). Das et al. (2019) The seeds of terminalia sp. had evaluated K (9285 ± 0.22 mg) was the uppermost, followed in plunging request by Ca (837.20±1.28 mg) and Mg (788.68 ± 0.21 mg). Meanwhile, Ladele et al. (2016) investigated (100g) of terminalia kernel minerals contained and recommended daily intake (RDI). Who reported that Mg (173.6–23.52% RDI), Fe (89.7–20.19% RDI), Zn (87.9–12.09% RDI) and Ca (41.5% RDI). In the recent past Dwivedi and Udupa (1989); Zannat and Kulsum (2003) found that the *T. arjuna* contained a rich amount of Mg (4000 mg/g) besides Ca (3133 mg/g), Zn (119 mg/g) and Cu (19 mg/g).

Das et al. (2019) The seeds of terminalia sp. nutritional characters to use them for humans. Immediate examinations showed that the seed contained 24.78% protein. Weerawatanakorn (2015) noted that *T. catappa* seeds contained high levels of protein. The most limiting amino acids were tryptophan and lysine. Arginine is a source for nitric oxide, and has a variety of bioactivities including vasodilation, anti-oxidant, and anti-platelet effects, many of which have consequences for the risk of cardiovascular disease. Wells et al. (2005); Wu and Meininger (2002). Meanwhile, Venkatachalam and Sathe (2006) noted that The first restricting essential amino acids were methionine and cysteine. on nuts. Unit and World Health Organization (1992) recommended for an infant between the ages of 2 and 5.

The prior study indicated that *T. bellirica* kernels vitamin B1, B2, C, and A, respectively, formed 0.19mg, 0.45mg, 0.79g, and 1.1mg. Molla et al. (2007). The previous study imdicated that terminalia contain hydroquinone, trans-cinnamic acid, genetisic trans-ferulic acid, vanillic acid Manikandan and Rejula, (2008). While cinnamic and vanillic acid used to enhance food flavor and taste Jelen (2019) .

CONCLUSION

The present results revealed that kernels of terminalia sp. coated with chocolate may be put to use as food Owing to the high nutritional content, it is suitable for both youth and elderly people (protein, fat, fiber, vitamins and minerals).

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تقييم محتوى ثمار بعض أنواع الترماليا المنزرعة بمصر

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الملخص

تهدف هذه الدراسة لتقييم المحتوى الغذائي لب ثمار أشجار ترماليا ارجونا وترمناليا برليكا وإظهار نسبة كل من البروتين والزيت والعناصر المعدنية بالإضافة الي الفيتامينات لتلك الأصناف كما انه تم عمل مقارنة بين محتوى الأحماض الدهنية لزيت صنفى الترماليا مع زيت تجارى للزيتون ومقارنة إضافة الشيكولاته للب لصنفى الترماليا مع منتج تجارى للسودانى مطعم بالشيكولاته من حيث الطعم والنكهة والشكل. اوضحت الدراسه المحتوى للبروتين (20.5 % و 27.5%) لكل من لارجونا والبرليكا كما انه سجلت البرليكا 34% مقارنة بالارجونه 22% من محتوى اللب للزيت كما يحتوي لب البرليكا علي 6.35% من الالياف. بمقارنة المحتوى زيت لب صنفى ثمار أشجار الترماليا بزيت الزيتون من الأحماض الدهنية تلاحظ تفوق زيت الترماليا من البالميتيك اسيد حيث سجل البرليكا 22.58% والارجونا 21.04% مقارنة بزيت الزيتون 13.3% كما انه تميز زيت الارجونا بوجود الوميجا 7 ذو الاستخدام الطبى بمقارنة زيت الزيتون في حين سجل زيت لب الترماليا 8.77% و 5.76% لكل من البرليكا والارجونا بينما سجل زيت الزيتون 2.37% من حامض الستريك ذو الطعم الجيد وهذا يدل علي استحسان طعم زيت الترماليا عن زيت الزيتون كما انه امتاز زيت الترماليا عن زيت الزيتون بوجود لاوميجا 6 بالإضافة لوجود اوميجا 3 لماله الأثر الممتاز علي الصحة العامه في حين زيت الزيتون يحتوي علي الوميجا 3 فقط. اوضحت دراسه تركيب البروتين من لأحماض الامينية الأساسية لوب الترماليا البرليكا والارجونا وهي ليوسين و فانيلين و لويوسين وايزو لويوسين وغيرها من الأحماض الامينية الهامه التي لايستطيع الجسم البشرى تكوينها ويحصل عليها عن طريق التغذية وهامه في العمليات الحيوية للجسم. بدراسة محتوى لب الترماليا من الأملاح المعدنية الهامة في العمليات الحيوية بالجسم تبين ارتفاع محتوى لب الترماليا من البوتاسيوم والمغنسيوم بالإضافة الي الكالسيوم . ناحية أخرى أوضحت الدراسة احتواء لوب الترماليا علي فيتامين B1 و B2 و A و C من الفيتامينات الهامة لبناء تكوين الجسم البشرى التي لا يمكن الاستغناء عنها. كما أوضحت الدراسة إضافة الشيكولاته إلي لوب الترماليا أعطي فرق معنوي في الطعم والنكهة واللون والشكل لصالح لوب الترماليا عند مقارنته بمنتج تجارى من السودانى مضاف له الشيكولاته. توصي الدراسة إلي إمكانية الاستفادة من لوب أشجار لصنفى البرليكا والارجونا من جنس الترماليا في التغذية كما انه يمكن الحصول علي منتج غذائي ذو صفات جيده عند إضافة الشيكولاته لها

الكلمات المفتاحية: ترماليا ارجونا وترمناليا برليكا, محتويات الحبوب, الأحماض الدهنية والأمينية