Plant Archives Vol. 21, Supplement 1, 2021 pp. 847-850 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
doi link : https://doi.org/10.51470/PLANTARCHIVES.2021.v21.S1.128

QUALITATIVE AND QUANTITATIVE PROPERTIES OF ISOLATE PROTEIN EXTRACTED FROM WHEAT BRAN AND BASIL SEEDS

Ali A. Khalaf *, Amera K. Nasser and Jaffer M. Jassim
Department of Animal Production, College of Agriculture, University of Basrah, Iraq
Corresponding author E-mail wwiiwwww9@gmail.com

ABSTRACT

The study was carried out in the laboratories of the Department of Animal Production/ College of Agriculture/ University of Basra with the aim of extracting a protein isolate from wheat bran and basil seeds. As well as the study included the estimation of yield, chemical composition and determining the quality and quantity of amino and fatty acids in both types of proteins**.** The results show that there were no significant differences) in calculating the yield of protein, moisture%, protein%, ash% and carbohydrate. Significant differences ($p \leq 0.05$) were found in fat% (0.16 & 2.31 for different protein respectively). The results also show that wheat bran protein contains alanine, cysteine, arginine and glycine amino acids with concentrations of 326.9, 241.7, 193.1 and 109.8 ppm, respectively. Basil seeds protein amino acids were histidine, threonine, alanine, tyrosine and cysteine with a concentration of 463.3, 947.4, 500.4, 846.6, 449.0 ppm, respectively. The results indicated that wheat bran protein contains palmitic, stearic and oleic fatty acids, with a concentration of 299.22, 17673.87, 861.04 ppm respectively. Basil seeds protein contains palmitic, palmitoleic, oleic and linoleic fatty acids with a concentration of 2309.39, 52617.73, 1605.18 and 145.20 ppm respectively.

Keywords **:** Protein isolate, wheat bran, basil seeds.

Introduction

Protein isolates are plant-based products that are high in protein (Zhang *et al.*, 2012). Proteins have an important role in the manufacture of food products because of their functional properties such as foaming properties, emulsification, viscosity, water absorption and fat binding in addition to high nutritional value. (Khalil *et al.,* 1985). Proteins are essential in animal and human food to provide essential amino acids that cannot been synthesized. Digestion breaks down proteins for use in metabolism if needed (Edwards & Jameson, 2020). Proteins perform many healthy functions within the bodies of living organisms: catalyzing metabolic reactions, replicating DNA, responding to stimuli, providing structure to cells and organisms, and transporting molecules from one place to another (Fleurence *et al.,* 2018). In addition, proteins have the advantage of being using as antioxidants depending on the type of amino acid (Zhang *et al.,* 2012). Wheat bran is a by-product of wheat flour it is characterize by its high content of protein, fat and minerals (Mousia *et al.,* 2004). Wheat bran is a dietary fiber that has important health functions such as speeding up the excretion of waste from the intestine, reducing the risk of bowel and rectal cancer, reducing the level of cholesterol in the blood, and aiding the growth of beneficial bacteria in the intestine (Brennan, 2005). Basil seed (*Ocimum bacilicum* L.) belongs to Labiate family and it is natural in Asia (Iran and India), Africa and America (Simon *et al*., 2013). The use of different parts of basil in traditional medicine for processing a wide range of diseases, Scientific studies have indicated that basil contains compounds oil that acts as powerful antioxidant, anticancer, antiviral, antimicrobial properties and Treating cardiovascular disease (Bozin *et al.,* 2006; Abi Beaulah *et al*.,2014). Proteins are divided commercially into animal protein and plant protein and because of the high price of animal protein it requires protein production from unconventional sources (untapped) and contain on the proportion of protein (Arshad *et al.,* 2007) The current study aims to extract protein isolates from wheat bran and basil seeds and to estimate some quantitative and qualitative characteristics of the protein isolate.

Materials & Methods

Samples collection and preparation

Samples were obtained from wheat bran and basil seeds from local markets in Basra. The basil seeds were cleaned and extracted according to what was mentioned by Al-Aubadi and Al-Ani (2017). after drying the samples, both the seeds of the basil and wheat bran were milled,–the fat was extracted, as mentioned by Al-Birawee & Nasser. (2019).

Protease extraction

The protein was extracted according to the method mentioned by AL-Sadoon & Naji (2016) with some modifications. Extracted using the extraction solution (1N) from sodium hydroxide (1:20) and protein was deposited using hydrochloric acid (HCL) (1N). Protein was dried using a Rowing device and stored in plastic bottles in the refrigerator.

Calculating the yield of isolated protein (Y)

The percentage of the isolated protein according to Razavi *et al*. (2009), was calculated from the following equation:

$$\text{yield} = \frac{\text{Weight of extracted protein (g)}}{\text{weight of sample (g)}} \times 100$$

The chemical composition of the protein extract

Moisture, protein, fat, Carbohydrate and ash percentages were estimated as described by Foroutan *et al*. (2019).

Fatty acid analysis

Fatty acids were estimated in the Ministry of Science and Technology using clarity– chromatography SW GAS chromatography DANI – master GC, Use column (DN 10), temperature (250), pressure (4PSI), and flow rate (1) ml/min.

Amino acid analysis

Amino acids were estimated in the Ministry of Science and Technology using clarity– chromatography SW Amino Acid Analyzer Use flow rate (2) ml/min.

Statistical analysis

Data of the present study was analyzed according to two samples t-test within the statistical program spss. (SPSS, 2006). Significant differences were taken at the level of 0.05

Results and Discussion

The yield and chemical composition

Table (1) shows the results of yield and chemical composition the table indicates the absence of significant differences between the yield of isolated wheat bran and isolated basil seeds (14.28 & 14.48) % respectively. The table also shows that there was no significant difference in the percentage of moisture, protein, ash, and carbohydrate between isolated wheat bran and isolated basil seeds (1.72 & 1.56) %, (89.90 & 87.00)%, (3.86 & 3.75)%, (4.36 & 5.40)% respectively, and find significant difference in the percentage of fat between isolated wheat bran and isolated basil seeds (0.16 & 2.31)% respectively. This difference is due to the higher fat content in the basil seeds. These results were better than those obtained AL-Sadoon & Naji. (2016) when studying chemical composition for isolate protein wheat germ and isolate protein fractionated wheat the percentage in to moisture, fat, protein, ash, and carbohydrate (4.95, 0.50, 74.00, 4.10, 16.45) % and (5.45, 0.45, 73,00, 4.40, 16.70)% respectively. Also these results were better than those obtained Hmod & Naji. (2017) when studying chemical composition for isolate protein for (lentil, chickpea and mung bean) was moisture (4.90, 3.05, & 2.90) % respectively, and protein (82.37, 76.12 &79.37) % respectively, and ash (2.50, 3.36 & 2.3) % respectively, and carbohydrate (10.23, 17.47 &15.43) respectively. The high protein content in this study is considered one of the important factors in the production of protein concentrates, nutritional supplements, in addition to their use in the food industry.

Table 1 : The yield and chemical composition of isolated protein (mean ± standard error)

Chemical composition	Isolated wheat bran	Isolated Basil Seeds
yield (Y)%	14.28 ± 0.0345^{a}	14.48 ± 0.0115^{a}
Moisture %	1.72 ± 0.0052^{a}	1.56 ± 0.1022^{a}
Fat%	0.16 ± 0.2144^{b}	2.31 ± 0.3021^{a}
Protein%	89.90 ± 0.1651^{a}	87.00 ± 0.6228^{a}
Ash%	3.86 ± 0.6621^{a}	3.75 ± 0.0845^{a}
Carbohydrate%	4.36 ± 0.0543^{a}	5.40 ± 0.1043^{a}

Means in the same row with different letters show significant differences (P<0.05).

The amino acids

The results of Figure (1) types of amino acids in sample isolate protein of wheat bran to contain Alanine, Cysteine, Arginine and Glycine are the main amino acids present its concentration about 326.9, 241.7, 193.1, and 109.8 ppm respectively. As in the table (2) While Figure (2) shows types of amino acids in sample isolate protein of basil seeds which contains Histidine, Threonine, Alanine, Tyrosine and Cysteine are the main amino acids present its concentration about 463.3, 947.4, 500.4, 846.6 and 449.0 ppm respectively. As in the table (2) the reason for the difference between wheat bran and basil seed proteins can be traced mainly to the amino acid sequence determined by the sequence of nucleotides in their coding genes that determine the amino acid sequence and the protein evolution into a special three-dimensional structure that determines the activity of this protein. (Yada., 2017). Those amino acids are important for the production of immune bodies and others providing the body with sulfur and producing most hormones (Edwards & Jameson, 2020).

Table 2 : The amino acids in isolate protein of wheat bran and basil seeds

Amino acid type (ppm)	Molecular formula	Isolate wheat bran	Isolate basil seeds
Histidine	$C_6H_9N_3O_2$	-	463.3
Threonine	$C_4H_9NO_2$	-	947.4
Alanine	$C_3H_7NO_2$	326.9	500.9
Tyrosine	$C_9H_{11}NO_3$	-	846.6
Cysteine	$C_3H_7NO_2S$	241.7	449.0
Arginine	$C_6H_{14}N_4O_2$	193.1	-
Glycine	$C_2H_5NO_2$	109.8	-

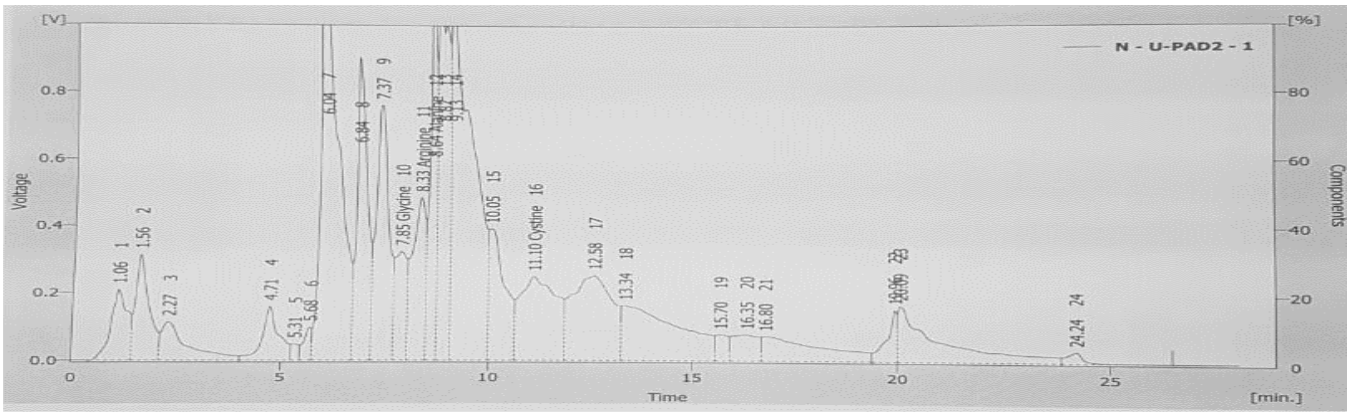

Fig. 1 : Types of amino acids in sample isolate protein of wheat bran

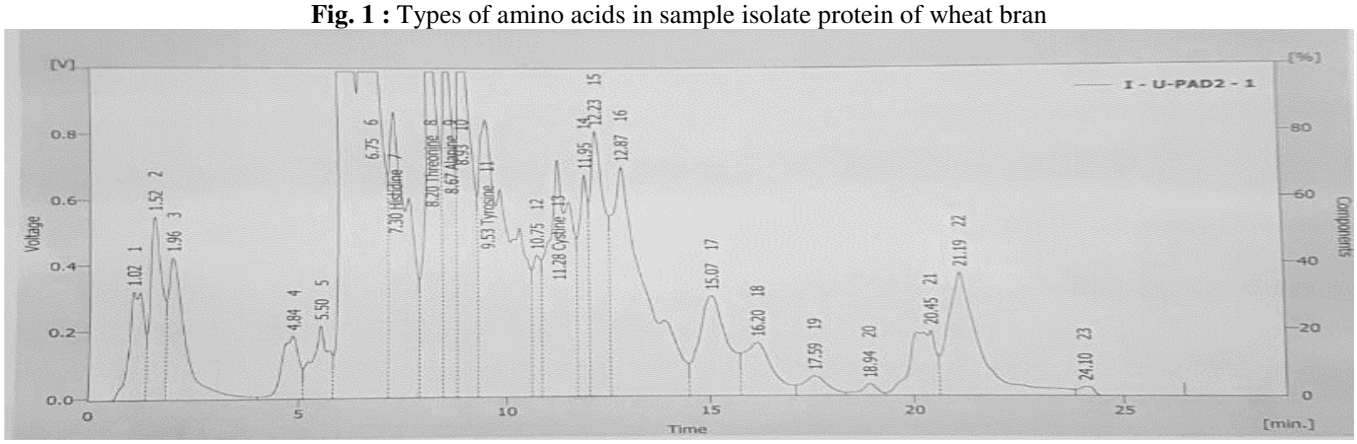

Fig. 2 : Types of amino acids in sample isolate protein of basil seeds

The fatty acids

The results of Figure (3) types of fatty acids in sample isolate protein of wheat bran to contain Palmitic, Stearic and Oleic are the main fatty acids present its concentration about 299.22, 17673.87 and 861.04ppm respectively. As in the table (3) While Figure (4) shows types of fatty acids in sample isolate protein of basil seeds which contains Palmitic, Palmitoleic, Oleic and Linoleic are the main fatty acids present its concentration about 2309.39, 52617.73, 1605.18 and 145.20 ppm respectively. As in the table (3). These results were consistent with what was found Angers *et al*. (1996) When studying seven types of basil seeds Where he found that the essential fatty acids Palmitic, Oleic and Linoleic. The study also agreed with the results Mostafavi *et al.* (2019) when studying 18 types of basil seeds and from various geographical areas it has been shown that the most important fatty acid in basil seeds is Palmitic, Oleic and Linoleic and that its concentration varies according to the genotype and the geographical area. This result encourages the use of these types of protein isolates as nutritional supplements, as they contain most of the fatty acids that the human or animal body needs to boost immunity and improve liver function And improve the performance of the nervous, muscular and reproductive system.

Table 3 : The fatty acids in the protein isolate of wheat bran and basil seeds:

Fatty acid type (ppm)	Molecular formula	Isolate wheat bran	Isolate basil seeds
Palmitic	$C_{16}H_{32}O_2$	299.22	2309.39
Palmitoleic	$C_{16}H_{30}O_2$	-	52617.73
Stearic	$C_{18}H_{36}O_2$	17673.87	-
Oleic	$C_{18}H_{34}O_2$	861.04	1605.18
Linoleic	$C_{18}H_{30}O_2$	-	145.20

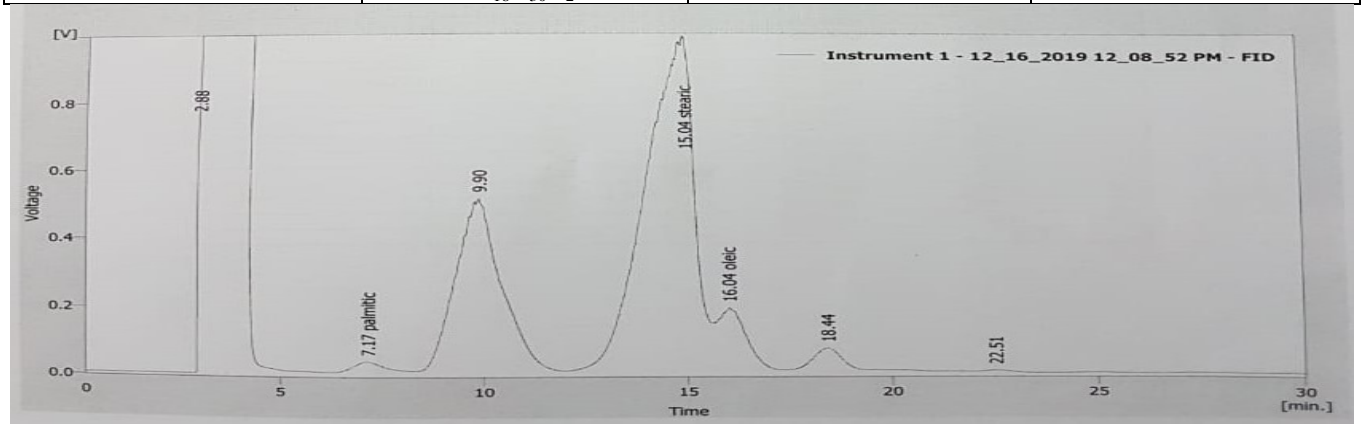

Fig. 3 : Types of fatty acids in sample isolate protein of wheat bran

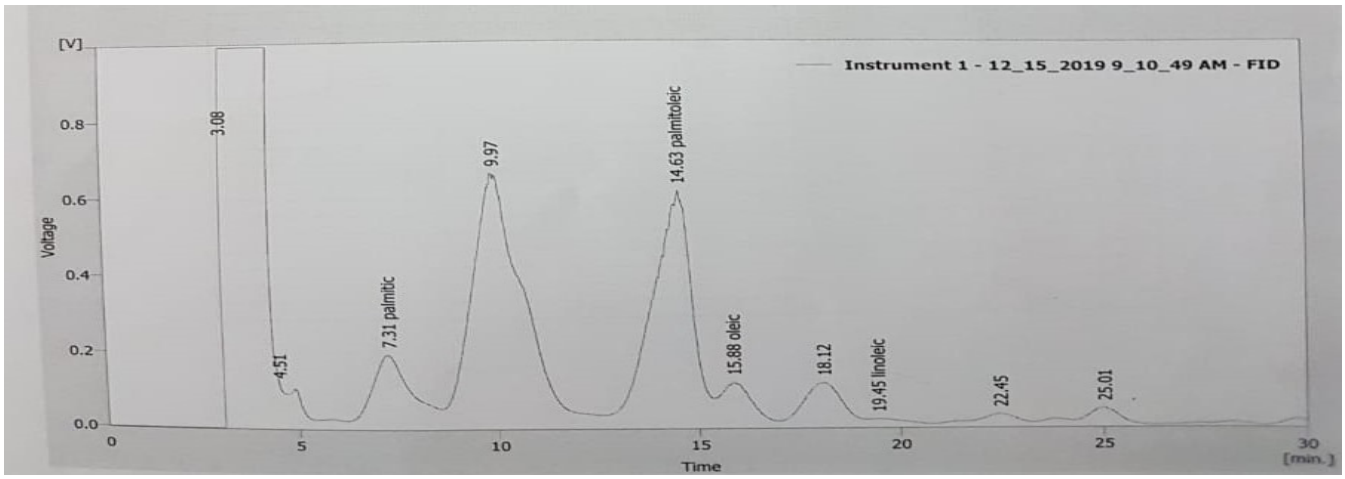

Fig. 4 : Types of fatty acids in sample isolate protein of basil seeds

Conclusions

The results showed that the protein isolate extracted from wheat bran and basil seeds contains a group of essential and non-essential amino acids that the body needs.

Acknowledgements

We extend our sincere thanks and appreciation to the Deanship of the College of Agriculture and to all members of the Department of Animal Production, especially Dr. Assad Yahiya Ayied for my help in statistical analysis and Dr. Hanaa Ali Jabber Al-Galbi for my assistance in the laboratory work

References

Abi Beaulah, G.; Mohamed Sadiq, A.; Sivakumar, V. and Jaya Santhi, R. (2014). Cardioprotective activity of methanolic extract of Croton sparciflorus on isoproterenol induced myocardial infarcted wistar albino rats. Journal of Medicinal Plants, 2(6): 01-08.

Al-Aubadi, I. M. K. and Al-Ani, M. T. H. (2017) Determination of the Physicochemical and Organoleptic Properties of Iraqi Basil Seeds Gum (*Ocimum basilicum*) and Detection of Phytochemicals. Journal of the Biotechnology Research Center. 11(1): 10-16.

Al-Birawee, A.R. and Nasser, A.K. (2019). Gel extraction from caper fruits (*Capparies spinosa L.*) and assess its effectiveness as antioxidants. Basrah J. Agric. Sci., 32(2): 74-84.

AL-sadoon, A.A. and Naji, E.Z. (2016). Evaluation of Chemical Composition and Study Some of the Functional Properties of the Flour and Isolated Protein from the Iraqi Wheat Industry Residue. Tikrit Journal for Agricultural, 16(4): 160-175.

Angers, P.; Morales, M. R.. and Simon, J. E. (1996). Fatty acid variation in seed oil among Ocimum species. Journal of the American Oil Chemists' Society, 73(3): 393-395.

Arshad, M. U.; Anjum, F. M. and Zahoor, T. (2007). Nutritional assessment of cookies supplemented with defatted wheat germ. Food chemistry, 102(1):123-128.

Bozin, B.; Mimica-Dukic, N.; Simin, N. and Anackov, G. (2006). Characterization of the volatile composition of essential oils of some Lamiaceae spices and the antimicrobial and antioxidant activities of the entire oils. Journal of agricultural and food chemistry, 54(5): 1822-1828.

Brennan, C.S. (2005). Dietary fibre, glycaemic response, and diabetes. Molecular nutrition and food research, 49(6): 560-570.

Edwards, P. J. and Jameson, G. B. (2020). Structure and stability of whey proteins. In Milk proteins (pp. 251-291). Academic Press.

Fleurence, J.; Morançais, M. and Dumay, J. (2018). Seaweed proteins. In Proteins in food processing (pp. 245-262). Woodhead publishing.

Foroutan, A.; Guo, A. C.; Vazquez-Fresno, R., Lipfert, M.; Zhang, L.; Zheng, J. and Wishart, D. S. (2019). Chemical composition of commercial cow's milk. Journal of agricultural and food chemistry, 67(17): 4897-4914.

Hmod, M. K. and Naji, E. Z. (2017). Extract Proteins from some Types of Pulses and Study Their Functional Properties. Tikrit Journal for Agricultural, 17(4): 234-246.

Khalil, M.; Ragab, M. and Hassanien, F. R. (1985). Some functional properties of oilseed proteins. Food/ Nahrung, 29(3): 275-282.

Mostafavi, S.; Asadi-Gharneh, H.A. and Miransari, M. (2019). The phytochemical variability of fatty acids in basil seeds (*Ocimum basilicum* L.) affected by genotype and geographical differences. Food chemistry, 276, 700-706.

Mousia, Z.; Edherly, S.; Pandiella, S. S. and Webb, C. (2004). Effect of wheat pearling on flour quality. Food Research International, 37(5): 449-459.

Razavi, S.M.; Mortazavi, S.A.; Matia Merino, L.; Hosseini Parvar, S.H.; Motamedzadegan, A. & Khanipour, E. (2009). Optimisation study of gum extraction from Basil seeds (*Ocimum basilicum* L.). Int. J. Food Sci. Technol., 44(9): 1755-1762.

Simon, J. E., Quinn, J., & Murray, R. G. (1990). Basil: a source of essential oils. Advances in new crops, 484-489.

SPSS (2006). Statistical Packages of Social Sciences. Version 15 for windows. SPSS. Inc..

Yada, R. Y. (Ed.). (2017). Proteins in food processing. Woodhead Publishing.

Zhang, H. J.; Zhang, H.; Wang, L. and Guo, X. N. (2012). Preparation and functional properties of rice bran proteins from heat-stabilized defatted rice bran. Food Research International,47(2):359-363.