



EFFECT OF FERMENTATION OF WHEAT BRAN AND BARLEY ON THE IMPROVEMENT OF NUTRITIONAL VALUE

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Abstract

This study was conducted in the Animal Production Department / College of Agricultural Engineering Sciences / University of Baghdad to show the effect of fermentation of wheat bran with Iraqi bioenergy and barley with kiwi fruit juice in nutritional value. The treatments included fermentation of wheat bran with one level of Iraqi bioenergy 5 gm /kg, for three periods 5, 10, 15 days, and divided to four treatments, the first one is W1 for wheat bran, W2 for Wheat fermented wheat bran for 5 days, W3 for Wheat fermented wheat bran for 10 days and W4 representing fermentation of wheat bran for 15 days. Barley was fermented with kiwi juice by 0.2, 0.4 and 0.8 % for 14 days. Treatments were divided to four groups: T₁ for raw barley without fermentation, T₂ barley fermentation by 0.2% Kiwi fruit juice, T₃ fermented barley by 0.4%, kiwi fruit juice, and T₄ fermented barley by 0.8% kiwi fruit juice. The results of the laboratory study showed that the fermentation process, whether using the Iraqi bioenergy or kiwi juice has increased the nutritional value of wheat bran and barley by increasing the ratio of crude protein and extract of ether with a decrease in raw fiber ratio compared to non-fermented raw materials.

Key Words : Fermentation, Nutritional Value, Wheat bran, Barley.

Introduction

Cereals and their residues are among the most common materials in the composition of poultry diets, including wheat, maize, barley and wheat bran. These materials are not free of food inhibitors, which are considered the most important problems faced by nutritionists because of their negative impact on domestic birds, as well as reducing the use of raw materials and these inhibitors including of polysaccharides, non-starchy compounds, manganese, beta-clocan, zeolane, tannic acid and fiber. The presence of these inhibitors affects the degree of digestion and absorption of feed material and also increases the viscosity of the gastrointestinal tract (Johri, 2005). The barley grains contain a high percentage of non-starchy polysaccharides, especially the B₂ Glucan compound (Ahmad, 2011), it also contains 5.5% fiber. While, wheat bran contains a high fiber level of up to 12% and a low digestion factor (NRC, 1994). In order to increase the use of barley and wheat bran in poultry diets, the process of improving the nutritional value of the fermentation process should be improved. The

fermentation process aims to increase the protein content and the extract of the ether and reduce the fiber ratio, as well as reduce the level of nutritional inhibitors in some grains. Some enzymes produced by microorganisms by fermentation process to improve digestion factor (Al-Mashhadani, 2012). Skrede (2003) points to a decrease in the level of raw fiber and the level of cloacan when fermenting barley with bioenergy. Zhu *et al.*, (2017) observed a rise in the ratio of raw protein when fermenting soybeans with bioenergy and a decrease in the level of anti-trypsin. Al-Janabi, 2014, pointed out that the fermentation of wheat bran with sheep seed fluid improved the nutritional value of bran by increasing the ratio of protein and some essential amino acids, as well as reducing the level of raw fiber. Due to the importance of fermentation process in improving the nutritional value of feeding materials. The aims of this study are:

1. The use of bioenergy in the fermentation of wheat bran and its impact on the nutritional value of wheat bran.
2. Use kiwi fruit juice to improve the nutritional value of barley.

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Materials and Methods

This study was conducted in the laboratories of the Animal Production Department, College of Agricultural Engineering Sciences, University of Baghdad, to investigate the effect of the fermentation process and the type of fermented materials in improving the nutritional value of wheat and barley brans.

Fermentation methods

Wheat bran and barley used in this study were purchased from local markets and fermented by the following ways:

Barley fermentation using kiwi fruit juice:

The kiwi was purchased from the local markets as the peels were removed and fruit juice was excreted by machine. The pH of the prepared juice was measured and it was about 2.65. The barley grains were moistened by adding water to 50% followed by the addition of kiwi juice with different percentages of 0.8.0.4.0.2%, then they were packaged in glass cans with a flaming candle inside the cans and close the glass cans tightly with a tape to exhaust the amount of oxygen inside the glass cans (to provide anaerobic conditions in the glass cans) to activate the anaerobic bacteria then incubate these glass containers at 37°C for 14 days. After that, the cans were opened and their contents were emptied and sprayed on a clean concrete floor in order to drying them. The samples were taken to the central laboratory at the Faculty of Agricultural Engineering Sciences for conducting tests.

Wheat bran fermentation using bioenergy:

The Iraqi bioenergy (containing four types of useful microorganisms) was used in this method, and the wheat bran was moistened by adding water to 50% of the wheat bran weight. After that, the bioenergy was added by 5 g / kg, then the wheat bran was well mixed and put in glass containers under anaerobic conditions. (The same method followed with barley) and fermentation for different periods 0, 5, 10 and 15 days, after that, samples were well dried and taken to the Central Laboratory for the chemical analysis.

Chemical Analysis

The ratio of nitrogen to chlorine and ether extract in wheat and barley brans before and after fermentation were determined by the saxolite methods as described by A.O.A.C. (1984). The chemical analysis was done in the Central Laboratory of the Faculty of Agricultural Engineering Sciences.

Results and Discussion

The results of the laboratory analysis for wheat bran samples before and after the fermentation using the bioenergy are shown in (Table 1). The results indicated a significant improvement ($P < 0.05$) in the percentages of crude protein and ether extract was observed in the treatment four W4 ($P < 0.05$) (fermentation of wheat bran with bioenergy for 15 days) compared to treatment one W1 for the row wheat bran. The results showed some improvement in all other fermentation treatments in protein, ether extraction. There was a significant increase ($p > 0.05$) in the percentage of ash content for the fourth treatment (W4) compared with the control treatment W1, while other fermentation treatments showed superiority accounting increase for the same property. Also, the results revealed a significant increase in the crude fabric for all treatments. There is no significant between treatment for calcium and phosphorus. The increase in the ratio of protein and the ether extract from the 4W treatment may be due to the role of microorganisms processed by the bioenergy as well as by the fermentation process. These organisms used the carbohydrate substances and convert them into nitrogen compounds by metabolism processes (Al-Mashhadani, 2011). Perhaps the increase in the level of protein in fermented wheat bran with the bioenergy may be due to the ability of fermented microorganisms to convert low-value feed to high-value feed through their ability to produce proteins as metabolites (Hassan and Aboud, 2011).

The data in table 2 show the effect of fermentation of barley at different levels of kiwi juice for 14 days on the biological value before and after the fermentation process. The results indicated that the fourth treatment (T_4) (fermentation with 0.8% kiwi juice) showed high significant effect ($p > 0.005$) on the percentage of crude protein compared to the control treatment T_1 . Also T_4 treatment exceeded the T_1 in the percentage of ether extraction. In addition, all other fermentation treatments were improved in both the crude protein and the ether extract compared to the T_1 . While no significant differences were observed in the percentage of Ash between all treatments.

The significant improvement in the nutritional value of barley in the treatment four T_4 (at 0.8%) of kiwi juice may be due to a decrease in the acidity of the added kiwi juice, which was about 2.65, as the acidic medium promotes the growth of beneficial acid microorganisms as well as providing the appropriate conditions for fermentation including moisture, and heat which improve the production of organic acids (2006, Kho).

Table 1: Chemical analysis of raw and fermented wheat bran used in the study (mean + standard error).

Treatments	Raw % protein	Raw fiber %	Extracted ether %	Ash %	Calcium %	Phosphorus %
W1	8.38±0.16	7.10±0.37	1.92±0.15	1.29±0.05	0.46±0.03	0.56±0.03
W2	8.88±0.21	6.66±0.16	2.17±0.13	1.48±0.01	0.48±0.01	0.52±0.02
W3	9.01±0.40	6.97±0.27	2.13±0.24	1.50±0.08	0.49±0.04	0.55±0.01
W4	9.31±0.17	6.91±0.22	2.37±0.12	1.56±0.11	0.45±0.01	0.52±0.01
Level of Significance	0.05	N.S	0.05	0.05	N.S	N.S

Where W1: non-fermented raw wheat bran, W2 Wheat bran fermented with bioenergy for 5 days, W3 wheat bran with bioenergy fermented for 10-day, W4: wheat bran fermented with bioenergy for 15-day.

Table 2: Chemical analysis of raw and fermented Barley used in the study (mean + standard error).

Treatments	Raw protein %	Raw fiber %	Extracted ether %	Ash %
T ₁	11.9±0.52	17.66±0.38	1.99±0.05	1.30±0.17
T ₂	12.4±0.58	17.49±0.28	2.1±0.12	1.44±0.13
T ₃	12.33±0.39	17.18±0.46	2.14±0.08	1.59±0.17
T ₄	13.01±0.29	16.39±0.23	2.35±0.02	1.43±0.12
Level of Significance	0.05	0.05	0.05	N.S

Where T₁ raw barley, T₂ fermented barley with kiwi juice 0.02%, T₃ fermented with kiwi juice 0.4%. T₄ fermented barley with kiwi juice 0.8%.

Microorganisms in the fermented materials also increase the nutrient availability of feed materials by the enzymes produced by these microorganisms (Ohu, Uchewa, 2012). Studies also indicate that the process of fermentation transforms complex of organic compounds into simple compounds by increasing the secretion of the enzymes that accompany this process such as catalase enzyme produced by yeasts and microbiology 2007, AKika, Willian). The improvement in the nutritional value of barley may also be due to the role of kiwi juice due to its content for certain enzymes such as acetylidene, bromelain, ficin and acetidine, which have a role in improving digestion factor proteins and fiber. This was reflected by the decrease in fiber percentage with increasing the level of kiwi juice (Salim *et al.*, 2007).

The results of this study indicated that the process of fermentation for both wheat and barley bran has led to improve the nutritional value of wheat bran and barley by increasing the level of protein and fat and reduce the proportion of raw fiber.

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