Some physical treatments on wheat bran for producing dietary fiber*

M. M. TABEKHIA**, S. A. EL-KADY*** and K. A. AMMAR***

Introduction

During the last years more attention has been given to dietary fiber than any single component of the diet has ever received. Dietary fiber acts as a bukling agent that increase intestinal motality and moisture content of feaces. It was postulated that those effects are important in preventing diseases of the colon, other studies showed evidence that plant fiber can lower serum cholesterol level and improve oral glucose tolerance in human. Fiber contains cellulose, hemicellulose, lignin and probably residues of protein, starch and pectic substances. From a dietary stand point, fiber can defined as the material that resists the digestion secretion of gastrointestinal tract.

Consumption of highly cereals, processed foods and frozen foods has increased in considerably in recent years. Decrease in the intake of fibers in the diet may therefore cause fiber deficiency diseases.

Wheat bran is a major source of dietary fiber (9–10%) crude fiber, but also is a rich source of phytate (3.5–4.0%), that can also binds some minerals when fed to mono-gastric animals in large amounts. Concerns were reported that phytate reduced the availability of dietary calcium, zinc, iron, copper, magnesium, and manganese. Thus the quality of dietary fiber becomes a nutritional factor particularly concerning phytate content.

The purpose of this study was to develop a new method for decreasing the amount of phytate wheat bran by phytase enzyme which can be produced spontaneously, and investigated the effect of dephytinization process on some physical, chemical and nutritional properties of low-phytate wheat bran.

Materials and methods

Commercial samples of wheat bran (Hard red spring), were obtained locally from the market. The samples were gently shaking to withdraw foreign materials. Preparation low-phytate wheat bran:

The procedure for preparation low-phytate wheat bran from wheat bran is shown schematically in Fig (I). The bran was soaked in distilled water for 30 minutes, after soakint period the soaked bran was dropped in a buffer solution. 0.1 M of soduim acetate in the presence of 0.002M $MgSO_4$ (pH value was range 5.0–5.2),

* Szerzők tanulmányaikat a Budapesti Műszaki Egyetemen végezték *(Szerk.)*

** Food Sci. Depart. Faculty of Agriculture, Mansoura University.
*** Food Technology Depart. Faculty of Agric. Kafr El-Sheik, Tanta University

PROCEDURE FOR PREPARATION LOW-PHYTATE WHEAT BRAN:

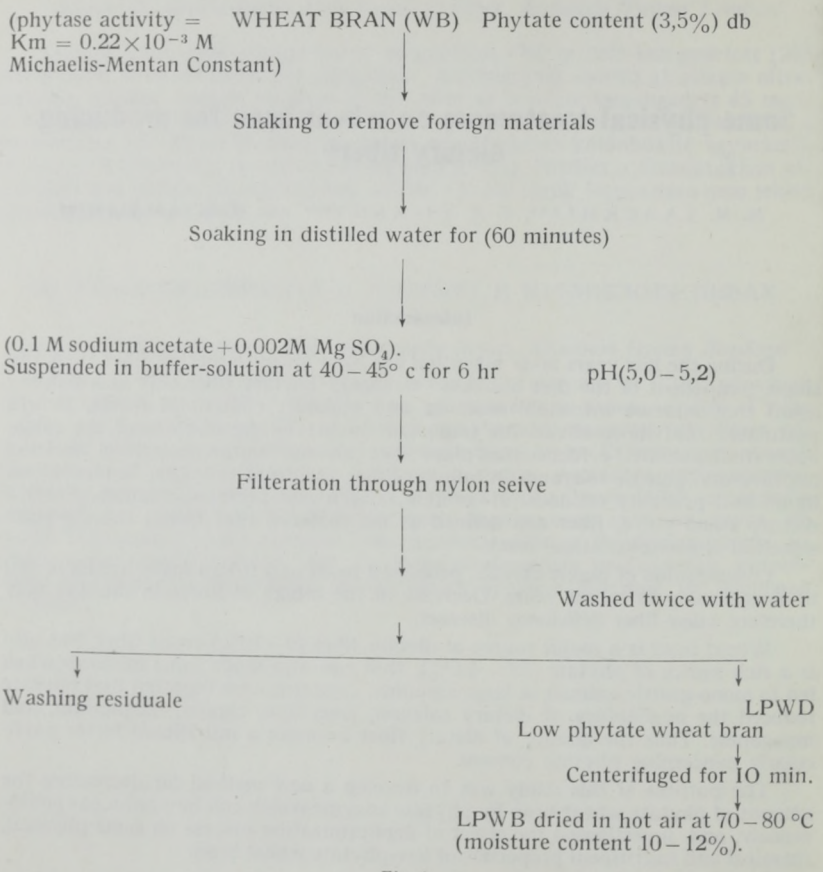

Fig. 1.

which was stored in a container and incubated at 40 – 45 °C for 6 hours. At the end of incubation period the suspension was filtered through a nylon sieve and the bran washed with water. Then the product centrifuged for 10 minutes to reduce the moisture content. The final product was dried in hot air at 70 – 80 °C to remove the moisture to a level 10%.

Analytical procedures:

1. Phytic acid content was determined in wheat bran before and after dephytinization process by the method described by *Wheeler and Ferrel* (1).
2. Phytase activity was measured by method by *Hassan and Singh* (1980).
3. Moisture, crude fiber were determined by AOAC procedure (1973).

4. Neutral detergent fiber (NDF) was measured by the method of *Van Soest and Wine* (2), modified to include an -amylase starch digestion step. Cellulose and lignin determined by the acid detergent fiber (ADF) method of *Van Soest* (3) as modified by Holst (4).

5. Particle size: A sample of 25 gm was placed on the largest of a descending seives of 20, 30, 40, 50 and 70 mesh stainless steel US standard sieves that were fitted with a par and a cover. The nested sieve were shaken for 10 minutes disassembled and contents were stirred lightly, then shaken for an additional 5 minutes. The residue of each sieve was carefuly removed with the aid of a brush weighed each residue was expressed as percent by weight of the original sample.

6. Water-holding capacity: Water-holding capacity was measured by the procedure of *Mc-Connel et al.* (5).

7. Density determinations: For density determination a calibrated graduate cylinder was filled with slight shaking with bran. The contents of the cylinder were weighed and the average of triplicate determinations was expressed as g/ml.

8. Hydrated density: A celibrated 10mL graduated cylinder was filled with a known amount of distilled deionized water, and a known weight of wheat bran was added carefully to avoid adhesion of particles to cylinder walls. Results expressed grams of sample bran per mL of water displaced.

9. Bulk density: Bulk density was measured with a calibrated graduate syring (open end packed with cotton). The syring was filled with a known amount of sample, which varied somewhat depending on particle size and density. Pressure was applied manually until additional pressure would not further reduce the volume.

Results and discussions

Proximate composition of wheat bran, crude fiber, acid detergent fiber, neutral detergent fiber, dietary fiber and phytic acid for AACC certificated wheat bran and wheat bran before and after dephytinization process was summarized in table (1). The disappearance of phytic acid after dephytinization process from 3.46% to 0.4% during the 6 hours at 40 °C of incubation period was caused by enzyme degredation as confirmed by phytase when involving at pH 5 – 5.2 adjustments. From results shown in Fig (1) it can be seen that a number of different factors influenced the hydrolysis of phytic acid during incubation period.

Holding the mixture of wheat bran under conditions allow the enzyme to affect changes in the mixture bran phytate, it was observed that wheat phytase does not hydrolysis all six phosphate from phytate, but only five phosphate to give inositol-monophosphate, phosphatase which produced by wheat enzyme split minosit monophosphate to inorganic phosphorus and inositole. It would seem, therefore that phytase requires a soluble substrate for its action and that the increased destruction which takes place with the lowering of pH is due partialy to the increased solubility of natural phytates.

Major sources of confusion are the term dietary fiber and crude fiber. Crude fiber is what remains of cell-wall constituents after treatment with acid, alkal and alcohol. Wheat bran contains about 22% cellulose and lignin. 25% hemicellulos and 6% total sugar. Microorganisms in the colon can, however digest the component of dietary fiber. The process of dephytinization process did bot alter the level of crude fiber. ADF, NDF and dietary fiber significantly, slightly changes were occured may be due to the solubility of some starch, pectin or hemicellulose content of wheat bran.

Table II

Effect of dephytinization process on particle size of wheat bran

Property	Particle size % sample retained onUS standard sieve mesh				
	20	30	40	50	70 > 70
AACC certificated wheat bran	9	33	17	9	1 Traces
Wheat bran before dephytinization process .	6	40	21	7	9 Traces
Wheat bran after dephytinization process	5	44	25	5	1 Traces

Table III.

Effect of dephytinization process on some physical properties of wheat bran

Property	AACC certificated wheat bren	Wheat bran before dephytinization process	Wheat bran after dephytinizat process
Direct density mg/ml	439	440	420
Bulk density g/CC	0.509	0.520	0.550
Water-holding capacity ml/g*	7.30	7.10	6.80
Hydtated density g/ml	2.10	2.00	2.20

* At pH 7.33

Table II. summarized and compared with known values of wheat bran AACC. Highe percentage of material were retained on the 30–40 mesh before and after dephytinization process. Some investigators linked diversity in particle size of fiber to increase in rate of water absorption in human colon. When bread with different amount of the same fiber (20–40 peashulls) were tested for the relationship of consumed cellulose to fecal volume, the correlation coeffcient increased to $r = 0.686$. This clamis that increase the mesh o (P. S) improve human nutrition. Bread made with different concenteration of 20–40 mesh peas hulls show an excellent correlation ($r = 0{,}980$) between fecal volume and dry matter digestability. Research suggest that the extent of milling also affect of physical characteristicof fiber containing foods. They indicated that mean particle size (MPS) increased the water-holding capacity, also rises. The bile salt binding was also correlate with log (MPS).

Effect of dephytinization process on densities and waterholding capacity:

Types of dry density measurements as well as measures of hydrated density are shown in table III. The AACC wheat bran compared with wheat bran before and after dephytinization process It was observed that densities did not change significantly after dephytinzation. The densities of wheat bran are capable of retaining water to some degree, and the water displacement or hydrated density value reflect the extent of hydration. It was noted in some cases the denser fiber soun exhibited the largest hydrated density values. The AACC bran considered of higher recorded densities among tze food fiber source.

Water-holding capacity: In this study several measures were carried to estimate water-holding capacity of wheat bran. Table III. showed that water-holding capacity was decrease from 7.10 to 6,80 ml/g. The causes of this changes may be due to hydration and drying process which can effect on cell-wall and change in holding capacity of water, the test was carried out at pH 7,3. Some data reflect that there was considred variations in response to pH variations. The nutritional

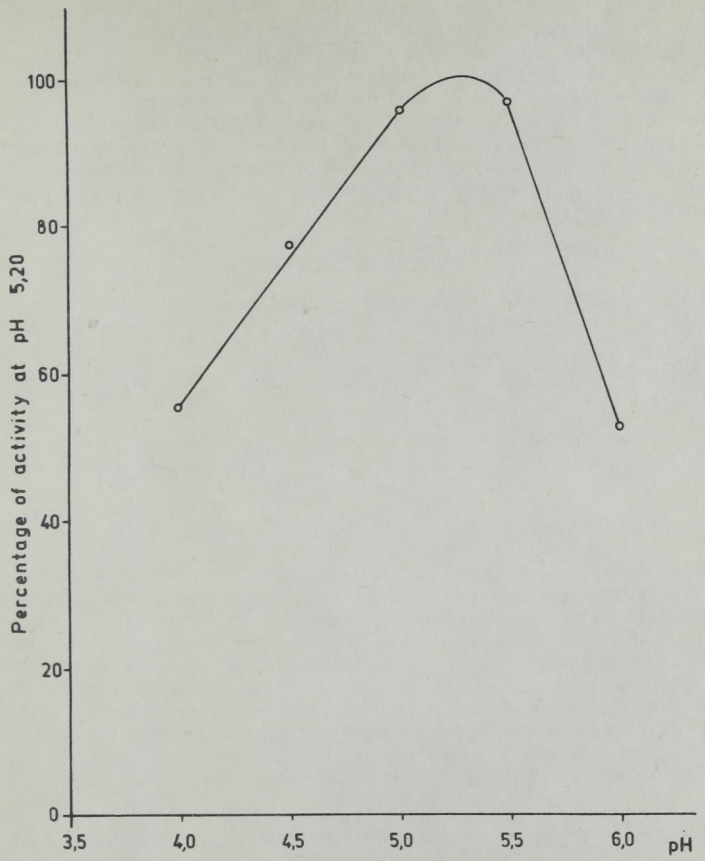

Fig. 2.

significance of water holding-capacity for wheat bran as density fiber. In general change in fecal out put reflect the digestability of the foods and their water-holding capacity and/or their breakdown into osmatically or physiologicall active components. Wheat bran had a greater water-holding capacity than oat bran or that wheat bran feeding increased motality sufficiently so that water holding effectively recovered from the intestinal contents.

Several publications had linked particle size with water absorption. It have shown that for certain dietary fiber a reduction in particle size results in a significance decline in estimated hemicellulose content a constituents largly responsible for hydrophilic characteristics and sonsequntly water-holding capacity. The same component was also shown to be partially solublized in particular fibers when exposed to acid or akali treatment. When AACC certificated wheat bran was exposed to pH 2,69 and 5,20 the water-holding capacity was 5,99 and 5,70 respec-

rively, means that the variation of pH in the acid side had insignificant effect the water-holding capacity of wheat bran. Hold wheat bran at 40–45 °C du incubation period for activation phytase enzyme had little effect on water-hol capacity. Some investigators showed that rise temperature to 100 °C resulte enlarged, elongated particle and structure damage will occured.

The most significant finding in this study was the reduction of phytic by this simple process by phytase activity of wheat bran and improve its nu tional value as a good source for dietary fiber for supplementary foods.

Further studies are needed to establish the nutritional evaluation of deph nization wheat bran.

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ÉTKEZÉSI NYERSROST ELŐÁLLÍTÁSA A BÚZAKORPA FIZIKA KEZELÉSÉVEL

Tabekhia, M. M.–El Kady, S. A.–Ammar, K. A.

A búzakorpa rostforrásként való felhasználása az emberi táplálkozásba látozott, a nagy fitintartalom (3,5–4%) miatt. Szerzők vizsgálták egyrészt pák fitintartalmát, másrészt tanulmányozták a fitintartalom csökkentés lehetőségeit fitáz enzim segítségével. A fitátok teljes lebontását búzakorpa s penzióban végezték pH = 5,0–5,2 acetát pufferben, 40–45 °C-on, 6 órán kere A kezelt terméket vizes mosás után félüzemi méretekben szárították 10–1 nedvességtartalomig. A kis fitintartalmú készítmény az eredeti fitáttart 10%-át tartalmazta. A sajátságok jellemzésére meghatározták a szemcsenag eloszlást, a vízkötőképességet és a sűrűséget. Az eredmények alapján az enz eljárás alkalmasnak látszik étkezési nyersrost készítésére.

HERSTELLUNG VON GENIESSBAREN ROHFASERN DURCH EINE PHYSIKALISCHE BEHANDLUNG DER WEIZENKLEIE

Tabekhia, M. M., El-Kady, S. A., Ammar, K. A.

Infolge des hohen Phytingehaltes (3,5–4,0%) ist die Verwendung der Weiz kleie als Faserquelle in der menschlichen Ernährung nur begrenzt. Es wurde einc seits der Phytingehalt von Kleien untersucht, andererseits wurden aber die Möglic keiten der Herabsetzung des Phytingehaltes mittels der Enzyms Phytase unte sucht. Die vollkommene Zersetzung der Phytate wurde in einer Weizenkleie suspension in einem Acetatpuffer vom pH 5,0–5,2 bei 40–45 °C sechs Stunden lan durchgeführt. Das behandelte Produkt wurde nach Waschen mit Wasser im halb betrieblichen Mass bis zu einem Feuchtigkeitsgehalt von 10–12% getrocknet. I dem an Phytin ärmeren Produkt blieb nur 10% des ursprünglichen Phytatgehalt zurück. Zur Kennzeichnung seiner Eigenschaften wurden die Verteilung der Korn grössen, die Wasseraufnahmefähigkeit und die Dichte bestimmt. Auf Grund de Ergebnisse scheint das enzymatische Verfahren zur Herstellung von geniessbare Rohfasern geeignet zu sein.

INHALT

...seren lesern ... 217

...rt, H. J.: Die Lenkung und Planung der Qualitätsentwicklung der Lebensmittel in der DDR in den 80-er Jahren (auf deutsch) ... 219

...mann, J.: Bestimmung durch die Geruchsorgane der Konzentrationen, Dampfdrücke und geruchsintensitäten von Aromastoffen in Lebensmitteln (auf deutsch) ... 225

...nann, R.: Über die Normung der sensorischen Untersuchung von Lebensmitteln (auf deutsch) ... 243

...la, Z., Sulkowska, J.: Qualitätsuntersuchung von fertigen Speisen, Lebensmittelkonzentraten (auf deutsch) ... 259

...schakov, A. S., Sarytschewa, L. A., Dolgov, W. A.: Biologischer Wert von exsudativen Schweinefleisch und Möglichkeiten zur Erhöhung dieses Wertes (auf russisch) ... 267

..., V.: Bedeutung der Wasseraktivität vom Standpunkt der mikrobiologie der Lebensmittel (auf englisch) ... 271

...i, T., Tenhunem, J., Hivri, T., Suihko, M.: Qualitätseigenschaften von Kümmelmustern unterschiedlichen Ursprungs (auf englisch) ... 281

...Montero, R.: Viskosität von kubanischen Melassen (auf englisch) ... 291

...El-Kady, Nedelkovits, J.: Wirkung der Wärmebehandlung auf das kommerzielle Traubenkernöl (auf englisch) ... 297

...el O. Garcia Roché, Luis Izquierdo Pérez, Armando Becquer Lombard: Nitrat- und Nitritgehalt von kubanischen Bieren (auf englisch) ... 303

...tia, M. M., El-Kady, S. A., Ammar, K.A.: Herstellung von geniessbaren Rohfasern durch eine physikalische Behandlung der Weizenkleie (auf englisch) ... 307

CONTENTS

...ur readers ... 217

...kert, H. J.: Direction and planning of the quality improvement of foods in the GDR in the eighties (in German) ... 219

...rmann, J.: Determination of the concentrations, vapour pressures and odour intensities of aroma substances in food s by means of the olfactory apparatus (in German) ... 225

...mann, R.: Standardization of the sensory investigation of foods (in German) ... 243

...zola, Z., Sutkowska, J.: Qualitative control of ready-cooked foods, ready-made meals (in German) ... 259

...ol'shakov, A. S., Sarycheva, L. A., Dolgov, V. A.: Biological value of exsudative pork and possibilities of increasing this value (in Russian) ... 267

...Bartl, V.: Significance of water activity in food microbiology (in English) ... 271

...Kuusi, T., Tenhunem, J., Hivri, T., Suihko, M.: Qualitative properties of caraway seeds (in English) ... 281

...Boue Montero, R.: Viscosity of Cubanese molasses (in English) ... 291

...Samir El-Kady, Nedelkovits, J.: Effect of heat treatment on commercial grapestone oil (in English) ... 297

...Miguel O. Garcia Roché, Luis Izquierdo Pérez, Armando Becquer Lombard: Nitrate and nitrite contents of Cuban beers (in English) ... 303

...Tabekhia, M. M., El Kady, S. A., Ammar, K. A.: Production of edible crude fibres by the physical treatment of wheat bran (in English) ... 307

Tájékoztató Olvasóinkhoz és Munkatársainkhoz!

Az Élelmiszervizsgálati Közlemények hat füzetben jelenik meg évenként egy kötetben.

A folyóirat az alábbi tárgykörökbe tartozó cikkeket közöl:

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A szerzők önálló vizsgálatain, kutatásain alapuló közlemények; élelmiszerek kémiai, fiziko-kémiai, műszeres, mikrobiológiai, radiológiai, higiéniai vizsgálataira vonatkozóan.

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A lapszemle keretében magyar folyóiratokban megjelent dolgozatok címjegyzékét és külföldi folyóiratok kivonatait ismerteti.

A közlemények tartalmáért a szerzők felelősek. A közleményeket tömören kell megfogalmazni. A kéziratokat gépírással 1,5-es sorközzel, 4–5 cm margóval, a lapnak csak egyik oldalára írva kell beküldeni. A szakkifejezéseket, vegyületneveket fonetikusan kell írni. Az irodalmi utalásoknál a szerzők vezetéknevét és keresztnevének kezdőbetűit, továbbá a mű címét, kiadásának helyét és idejét, illetve a folyóirat kötet-, oldal- és évszámát kell feltüntetni a dolgozatok végén. A kézirathoz csatolni kell a munka magyar nyelvű rövid összefoglalását 3 példányban.

Kéziratokat a szerkesztőség nem ad vissza. A kefelevonatokat a margón kijavítva azonnal vissza kell küldeni. Az esetleges ábrák levonatát a kefelevonat szélére kell ragasztani a megfelelő helyen és ellenőrizni kell azok számozását és aláírását.

Önálló közleményekből a szerzők kívánságára 50 db különlenyomatot adunk.

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Szerkesztőség: 1052 Budapest V., Városház u. 9–11.
Felelős kiadó: Siklósi Norbert – Kiadja a Lapkiadó Vállalat
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MÉM Élelmiszerellenőrző és Vegyvizsgáló Központ, bev. szla. Budapest
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Előfizetési díj: 1 évre 300,– Ft
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H–1389 Budapest, Postafiók 141
81.1083. Állami Nyomda, Budapest
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