# التقييم الكيميائي والحيوي للكيك المحتوى على النشا المقاوم والألياف الغذائية

رسالة مقدمة من

**سهير طاهر عبدا لمنعم الحديدي**

بكالوريوس في العلوم الزراعية (انتاج زراعى) -كلية الزراعة -جامعة القاهرة-1982

**ماجستير ( اقتصاد منزلي ريفي )-كلية الزراعة- جامعة** القاهرة -**1994**

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**الدكتوراه فى فلسفة العلوم الزراعية**

**( اقتصاد منزلي ريفي )**

**قسم الصناعات الغذائية**

**فرع اقتصاد منزلي ريفي**

**كلية الزراعة**

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# CHEMICAL AND BIOLOGICAL EVALUATION OF CAKE PRODUCTS CONTIANING RESISTANT STARCH AND DIETARY FIBER


**BY**

**SOHAIER TAHER EL- HADIDI**

**B.Sc. Agric. Sci. (Agric. Production), Cairo Univ., 1982**

**M.Sc. Agric. (Rural Home Economic), Cairo Univ.,1994**


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# Approval Sheet

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By

***Sohaier Taher EL-Hadidi***

This thesis has been approved by:

Prof. Dr: Salah, K. EL-Samahy .....
Professor of Food Science,
Faculty of Agriculture
Suez Canal University

Prof. Dr. Enayat. M. Hassan .....
Professor Food Science (Home Economic),
Faculty of Agriculture
Cairo University

Dr: Mohamad M. EL-Nikeety .....
Associate Professor of Food Science,
Faculty of Agriculture
Cairo University

Dr: Mahamood. A. A Bekheit. .....
Associate Professor of Food Science,
Faculty of Agriculture
Cairo University

Committee in Charge
Cairo University

Date / / 2006

صفحة الموافقة

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( اقتصاد منزلي ريفي )

**وقد تمت مناقشة الرسالة والموافقة عليها**

أ.د/ صلاح كامل السماحي
أستاذ الصناعات الغذائية ..... 
بزراعة قناة السويس

أ.د/ عنايات محمود حسن
أستاذ متفرغ الصناعات الغذائية .....
(اقتصاد منزلى) بزراعة القاهرة

أ.د/ محمد محمد أحمد النقيطى
أستاذ الصناعات الغذائية المساعد .....
بزراعة القاهرة (مشرفاً)

أ.د/ محمود على أحمد بخيت
أستاذ الصناعات الغذائية المساعد .....
بزراعة القاهرة (مشرفاً)

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# 1-Introduction

Attention has been focused recently on the role of fiber in human nutrition. Dietary fiber is a generic term that includes plant constituents which are resistant to digestion in the human gastrointestinal tract **Adel-Magied, (1991**).

Products of plant origin like cereals, vegetables and their products are main sources of fiber for human.

The contents of dietary fiber and its fractional composition in plants are differentiated. Hemicellulose is dominated in cereals, while pectin and cellulose are dominated in vegetables and fruits.

The human consumption of products containing dietary fiber has increased due to the heath benefits that they offer **Gorecka, *et al*. (2002).**

At present time in Egypt, special interest attached to people with health problems which are required special foods included the patients with heart disease and diabetes as well as obesity since very important nutritional properties of dietary fiber is connected with adsorption bile acid and cholesterol. Bile acids salts may form with fibers complexes that are not absorbed and are next excreted with fecal. Faster cholesterol metabolism and bile acid salts synthesis in liver as well as lowering cholesterol (LDL fraction) level in blood plasma accurse at the same time **Johnson, (1990**)

Dietary fiber has been associated with cholesterol lowering properties which can reduce the danger of arterial blood diseases **Kahlon, *et al*. (1998).**

Cereal products are considered to be high caloric foods because they contain a considerable amount of carbohydrates **Ranhotra *et al*. (1992).** So bakery products such as cake and biscuit are favorable food for all persons, working to improve its quality, flavor, nutritional value and medical use is request we try to achieve. Cake is a confectionary favorite product for Egyptian people and its use in their breakfast at tea time. It is either home made or prepared on commercials scale **Abd-EL-kader (1995).**

The major source of dietary fiber is wheat bran. However; it has a high level of phytic acid (3.39 %) which can bind with some minerals. Resistant starch could be a new source of dietary fiber, which avoids the unfavorable high phytate content which found in wheat bran. Carrot (***Daucus Carota L***.) which belongs to the family umbelliferae is one of the important vegetable crops in Egypt and other countries **FAO, (1987**).

Besides a pleasant taste, carrot contributes to intake of carotene, minerals and dietary fiber Also; carrots are used as a special food for infants suffering from diarrhea **Dobszay and Sarkany (1975**). Furthermore, carrots have been

reported to have beneficial effects on fecal bulk, carbohydrate and lipid metabolism **Nyman, *el al*. (1990**).

Resistant starch is defined as the sum of starch food and products of starch degradation not absorbed in the small intestine of healthy individuals because resistance starch has low reduce caloric content and is characterized by physiological effects that make it similar to dietary fiber(DF) **Delcour and Eerlingen, (1996).**

**Hung, *et al.* (2005)** reported that the retrogradation of amylose is a major cause for formation of resistance starch (RS). Therefore, starch with high amylose content is believed to produce high levels of resistance starch (RS) in baking and food processing. High amylose maize starch is the preferred starting material for producing high (RS) ingredients and many publications reported the formation of RS from high amylose maize starch.

Moreover, resistance starch is a free of gritty mouth feel and unlike traditional fiber sources, is reported to be not alter flavor and textural properties of foods. These characteristics can improve the processing and quality of foods such as baked extrudes products where RS resistance starch may be added **Ranhotra, *et al.* (1996**).

**Topping (1991)** mentioned that plasma cholesterol and triacylglycerol (TAG) may be affected by resistant starch in the same manner by non-starch polysaccharides (NSP).

A number of national and international bodies have deliberated on the optimum intake of dietary fiber all have agreed that on average of dietary fiber intakes of western populations should be elevated by increasing the consumption of fiber rich foods. Also, the Nordic Nutrition Recommendations recommended dietary fiber intake of 3 g / MJ (12 g /1000 Kcal) and those of the National Advisory Committee on Nutrition Education Advocate on average of about 30 g/day, the finish recommendation is 6.3 – 8.4 g / MJ (30- 35 g / day) as mentioned by **Plaami (1997)**

The present investigation was made to study the possibility of using some dietary fiber sources in production of some bakery products and its effect on chemical and physical characteristics.

## The Aim of this investigation:

The investigation was carried out to study the main following points:-

- Studying the physical and chemical characteristics of different sources rich in dietary fiber (wheat bran, carrot powder) comparing with new source of dietary fiber (resistant starch).

- Using different sources of dietary fiber in some bakery products (sponge cake and biscuit).
- Studying the effect of adding of different sources of dietary fiber on the staling, rheological and organoleptic characteristics of the produced bakery products.
- Evaluation the biological effects of different sources rich in dietary fiber on hypercholesterolemic rats and the bioavailability of some minerals.

# *2-Review of Literature*

## 2.1-Chemical composition of raw material:

### 2.1.1- Wheat Flour:

Wheat flour is considered the main raw material for different baking industries as a bread, biscuits, cake, pastry products and macaroni. It is the back bone of nutrition for almost developing countries **Hussein (1990).**

**El-Badrawy (1994)** studied the chemical composition of wheat flour (72 % extraction) and found that it contained 84.35% total carbohydrates, 13.11% protein, 1.51% lipids, 0.41% fiber and 0.62% ash (on dry weight basis).

**Farvili, *et al.* (1997)** stated that soft red winter wheat flour (72 % extraction) contained 13.1% moisture, 9.7% protein and 0.45% ash. While the hard red winter flour (72 % extraction) contained 12.70% moisture 11.23% protein and 0.52% ash.

**Aly (2000)** found that wheat flour (72 % extraction) contained 11.92-12.1% moisture, 13.07-13.19%. Protein, 0.99-1.24% fat, 0.37-0.56% fiber, 0.48-0.68% ash and 72.99 - 84.33% total carbohydrates (on dry weight basis).

**Doweidar (2001)** found that protein, carbohydrate, lipids, ash and fiber contents of soft wheat flour (72 % extraction) were 8.97, 89.21, 0.67, 0.44, and 0.71% on dry

weight basis, respectively. While the hard wheat flour (72% extraction) contained 11.57% crude protein, 86.29% total carbohydrates, 0.84 % fat, 0.56% ash and 0.74% crude fiber on dry weight basis.

**Miguel, *et al.* (2003)** reported that the wheat flour (72 % extraction) contained 10.1% moisture, 10.2% protein, 1.5% fat, 0.5% crude fiber, 0.6% ash, and 77.1% total carbohydrates, respectively on dry weight basis.

**Abdel-Rahim, *et al.* (2004)** reported that wheat flour contained moisture 12.10%, protein11.75%, fat 0.85, fiber 0.75% and ash 0.57, on dry weight basis.

**Ragab, *et al*. (2005)** studied the chemical composition of wheat flour (extraction 72%) They found that moisture crud protein, fat, ash crude fiber were 14.0, 9.9, 1.2, 0.48, and 0. 5 %. respectively

**2.1.2- Wheat bran:**

**Vetter (1984)** reported that bran is the coarse outer layer of the wheat kernel and contained 7.5-12.0% crude fiber.

**Ranhotra, *et al.* (1994)** showed that wheat bran and the closely related mill fraction shorts consists of primarily aleurone layer, seed coat, and the pricarp layer of wheat. They represent about one-fifth of the wheat kernel. Wheat bran

typically contained 6-7% ash, 14-16% protein, and 45-50% dietary fiber. Air classification of wheat bran into coarse, fine and a fraction rich in nutrients indicated that the rich fraction (14% yield) in comparison with bran contained more protein (22% vs. 14.9%) more ash (14.7% vs. 6.9%), more fat (6.1% vs. 2.7%) and more soluble fiber (5.2% vs. 2.4%), but contained less total dietary fiber (24.5% vs. 49.2%) This fraction also contained 24% more Ca, 76% more K, 89% more Zn, 107% more Cu, 109% more Fe, 123% more Mg, 142% more P, 44% more riboflavin, 94% more thiamin, and 117 % more niacin than that of original bran.

**Galal (1998)** reported that the chemical composition of wheat bran content were 13.71% moisture, 14.16% protein, 4.01% ether extract, 3.62% ash, and 10.72% crude fiber.

**Abdel-Hafez (2005)** noticed that the chemical composition of wheat coarse bran was moisture 14.73, protein 16.5% fat 2.9%, crude fiber 10.02 %, ash 9.9% and total carbohydrate 48.55% on dry weight basis

### 3.1.3- Carrot :

**Matthee and Appledorf (1979)** found that the fresh carrot contained 88.4% moisture, 5.22% crude fiber, 1.32% lignin 1.04% hemicelluloses and 9.7% cellulose.

**Awad (1988)** reported that carrot contained 88% moisture, 4.02% reducing sugars, 3.5% non-reducing sugars, 7.55% total sugars, and 26.7 mg/100gm total carotenoids on fresh weight basis.

**Abdel-Latife (1990**) mentioned that chemical composition of dried powder carrot pomace (as % on dry weight basis) was as follows: moisture 7.0 %, protein 8.38 %, ether extract 2.51 %, crude fiber 27.890 %, ash 5.44 %, reducing sugars 5.67 %, non reducing sugars 0.5%, total sugars 6.17 %, water soluble pectin 3.40%, cellulose 25.48%, lignin 7.64%, other fiber 24.41%, dietary fiber 67.48%; and total carbohydrates 48.78%.

**Attia, *et al*. (1994)** found that chemical composition of carrot (on dry weight basis) were 6.79% moisture, 3.47% proteins, 2.15% ether extract, 0.17 ash, 10.5% crude fiber, and 31.25 % total carbohydrates.

**Youssef (1997)** mentioned that the chemical contents of raw carrot were 88.0, 1.2, 0.3, 8.40, 1.10 and 1.0%, for moisture, protein, fat, total carbohydrate, crude fiber and ash. He also found that the mineral contents of carrot were 39, 37, 0.8, 4.7 and 3.41 mg/ 100g for Ca, P, Fe, Na and K, respectively.

**Ally (2001)** noticed the chemical composition of dehydrated carrot (on dry weight basis) contained 6.37% protein, 1.68% fat, 5.65% ash, 9.52% crude fiber and 76.87% total carbohydrates. Also he added that the total dietary fiber, insoluble dietary fiber and soluble dietary fiber were 25.60, 15.34 and 10.26%, respectively. Moreover, the results also indicated that ∝-carotene, B-carotene and total carotenoid and vitamin A content were 13996, and 49542 mg/100g, 76.62 and 9423.33 units, respectively. However, the mineral contents were as follows: 138.70, 456.97,7.73, 0.29, 8.55, 184.10, 2135.5 and 1.581 mg/100g dry wt for Mg, Na, Zn, Mn, Fe, Ca, K and Cu, respectively.

**Doweidar and Mohamed (2005)** reported that chemical composition of dry carrot contained 9.30% protein, 2.90% fat, 6.93% ash, 7.06% crude fiber and 73.81% carbohydrate.

## 2.1.4- Starch:

**Hizukuri, *et at.* (1981)** reported that starch is a major reserve polysaccharide in plants. It is found in high levels in roots, tubers, cereal grains and legumes and percent intercellular granules with different sizes and shapes depending on the starch source. In the diet of many kinds of animals, it is one of the most important carbohydrates. It