

**ENVIRONMENTAL CHEMICAL STUDIES ON SOME
CONCENTRATED ACTIVE COMPONENTS EXTRACTED
FROM BARLEY**

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**A Thesis Submitted in Partial Fulfillment
Of
The Requirement For the Doctor of Philosophy Degree
In
Environmental Sciences**

**Department of Environmental Basic Sciences
Institute of Environmental Studies and Research
Ain Shams University**

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ABSTRACT

Much attention has been paid recently to improving the nutritional value of foods. Notably, cereal foods have been negatively affected with the popularity of "nutritional" diets, such as the Atkins diet. Barley (*Hordeum vulgare* L), is an ancient crop plant, and is also one of the world's most cultivated cereal crops. β -glucan is the effective naturally occurring compound that exists in the barley grains, which is a rich fiber fraction found as glucose polymer in the endosperm cell walls of barley and usually at a level of 2-8 % of grain weight. The objective of this study was to investigate the possibility of improving the bakery products by incorporation of high dietary fiber compound as β -glucan extracted from barley and the barley itself. Different extraction processes were analyzed in terms of their effects on β -glucan yield, processing characteristics and cost effectiveness. Extraction treatment affected the yield of barley β -glucan (BBG) fiber fraction, and β -glucan recovery efficiency ($P \leq 0.05$). Functional properties of extracted β -glucan gum as solubility, viscosity, foaming properties, water hydration and fat absorption capacities were determined. Its chemical composition and physical properties make it a functional ingredient which can be used in different healthy food products, thus its health benefits are linked to its high viscosity and its nature as a soluble dietary fiber. These characteristics make it suitable as a fat replacer in food products, and repeated trials were carried out to incorporate it in cake as egg replacer by different levels of substitution (0, 25 and 50%). Low calories white layers cake was prepared using β -glucan as fat replacer by different levels of substitution (0, 50 and 75%). Also, different products as soft cake, pan and balady breads were made using whole barley flour and β -glucan as partial substitutes of wheat flour. It was necessary to accomplish this investigation to study the physical, chemical and phytochemical properties of the above constituents. Also, physical properties, chemical compositions, sensory evaluation and staling rate of all prepared products were evaluated. The results of this study showed that the prepared products have acceptable nutrition values.

Keywords: Cereal foods, β -glucan, extraction processes, food products, phytochemical properties, nutrition values.

LIST OF ABBREVIATIONS

AACC: American Association of Cereal Chemists
AOAC : Association of Official Analytical Chemists
AWRC: Alkaline water retention capacity
BG: β -Glucan
BBG: Barley β -glucan
cp: centipoises
DF: Dietary fiber
DRI: Dietary Reference Intakes
EFSA: European Food Safety Authority
FAC: Fat absorption capacity
FAOSTAT: Food and Agriculture Organization of the United Nations
FDA: Food and drugs administration
FNB: Food Nutrition Board
FSANZ: Food Standards Australia and New Zealand
GI: Glycemic index
GOP: Glucose- oxidase –peroxidase
HB: Hull less barley
HGCA: Home-Grown Cereals Authority
IDF: Insoluble Dietary Fiber
IPA: Iso-propanol
LSD: Least significance differences
NHANES: The National Health and Nutrition Examination Survey
OB: Oat β -glucan (Nutrim)
PBF: Pearled barley flour
SDF: Soluble dietary fiber
TDF: Total dietary fiber
TPC: Total phenolic content
USDA: United States Department of Agriculture
WBF : Whole barley flour
WHC: Water Hydration Capacity

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