EFFECT OF SPROUTING USING SALINE WATER ON THE COMPOSITION AND NUTRITIVE VALUE OF PROTEINS IN CLOVER SPROUTS AND SOAKED WATER FROM BARLEY SPROUTS

By

ATEF ABD- ELAZIM EL- GEBALY

B.Sc. Agric. Cooperation Sc., High Institute for Agricultural Cooperation, 2006

A Thesis Submitted in Partial Fulfillment

Of

The Requirements for the Degree of

MASTER OF SCIENCE

in

Agricultural Sciences

(Advanced Agricultural Systems For Arid Lands)

Arid Land Agricultural Graduate Studies and Research Institute

Faculty of Agriculture

Ain Shams University

2018

Approval Sheet

EFFECT OF SPROUTING USING SALINE WATER ON THE COMPOSITION AND NUTRITIVE VALUE OF PROTEINS IN CLOVER SPROUTS AND SOAKED WATER FROM BARLEY SPROUTS

By

ATEF ABD- ELAZIM EL- GEBALY

B.Sc. Agric. Cooperation Sc., High Institute for Agricultural Cooperation, 2006

This thesis for M. Sc. degree has been approved by:

Dr. Emam Abd El-Mobdy Abd El Rahim **……..……..**
Prof. of Biochemistry, Faculty of Agriculture, Cairo University

Dr. Ayman Farid Abou Hadid **……..…….**
Prof. Emeritus of Vegetable Crops, Faculty of Agriculture, Ain Shams University

Dr. Mamdouh Mohamed Fawzy Abdallah **……...…**
Prof. Emeritus of Vegetable Crops, Faculty of Agriculture, Ain Shams University

Date of Examination: 19/ 9 / 2018

EFFECT OF SPROUTING USING SALINE WATER ON THE COMPOSITION AND NUTRITIVE VALUE OF PROTEINS IN CLOVER SPROUTS AND SOAKED WATER FROM BARLEY SPROUTS

By

ATEF ABD- ELAZIM EL- GEBALY

B.Sc. Agric. Cooperation Sc., High Institute for Agricultural Cooperation, 2006

Under The Supervision of:

Dr. Mamdouh Mohamed Fawzy Abdallah

Prof. Emeritus of Vegetable Crops, Department of Horticulture, Faculty of Agriculture, Ain Shams University. (Principle Supervisor)

Dr. Yasser Abd El Gawad El Gabry

Lecturer of Crops Faculty of Agriculture, Department of Crops, faculty of Agriculture, Ain Shams University

Dr. Sanaa Abd El Hamead mahfouz

Head of Nutrition Research, Regional Center for Food and Feed, Agricultural Research Center, Giza, Egypt.

ABSTRACT

Atef Abd Elazim El Gebaly: Effect of Sprouting Using Saline Water on the Composition and Nutritive Value of proteins in Clover Sprouts and Soaked Water from Barley Sprouts. Unpublished. M.Sc. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2018.

The effect of salt stress on growth chemical analysis, amino acid profile, Protein quality and fractionations as well as mineral content of clover sprouts. Biogenic amine and juice sensory evaluation of barley sprout were also determined, in 3 days etiolated clover and barley sprout samples was investigated. Sterilized and non-sterilized clover seeds and barley grains were sprouting using tap water as well as 1000 and 2000 ppm NaCl solution. The results showed reduction effect of clover sprout characters related with higher NaCl concentration. Clover seed sprouting increased the crude protein content using tap water or saline water for sprouting as compared with dry seeds. However using non-sterilized clover seeds for sprouting recorded the higher values of protein (44.73%), lipids (6.21%) and energy (318.51 kcal/g) in etiolated sprouts, while using sterilized seeds recorded higher carbohydrate (21.28%), fiber (14.57%) and ash (4.46%). For amino acids, aspartic acid followed by glutamic acid were the most abundant, while cysteine and methionine were the least in clover etiolated sprouts. Using saline water for clover seed sprouting caused increases in all amino acid compared with tap water except methionine, aspartic acid and cysteine. For protein efficiency ratio (PER), essential amino acid index (EAAI%) and biological value (BV), etiolated clover sprouts using saline water for sprouting had the higher values than sprouts using tap water, but the values are less than dry seeds. On the other hand nutritional index (NI) recorded higher values in salt

stress compared with both using tap water and dry clover seeds. For protein fraction in etiolated clover sprouts albumin was the major protein fraction extracted from NaCl 2000ppm sprout fallowed by prolamin from tap water sprouts, glutelin from NaCl 1000 ppm sprout and globulin from tap water sprout. Finally this study observed that saline water can be used for sprouting barley and clover seeds without any harmful effect on the nutritional value. Sterilization of seeds can be recommended before sprouting process especially for barley seeds when used to produce barley sprout juice.

Key words: Seed sprouting, proximate analysis, protein quality, Amino acid profile, protein fraction, barley juice, Biogenic amine Salinity, proteins.

ACKNOWLEDGEMENT

First of all, I am and foremost, I feel always indebted to **ALLAH**, the most beneficent and merciful for his great generous and for guiding me to carry out this work.

I would like to express my deepest gratitude and pay my respect to **Dr. Mamdouh Mohamed Fawzy Abdallah**, Professor Emeritus of Horticulture, Faculty of Agriculture, Ain Shams University, for his supervision, suggesting the research project, his valuable advice, continuous guidance, and great support as well as great help during the preparation of this manuscript.

All my regards, thanks and respect to **Dr. Yasser Abd El Gawad El Gabry** Lecturer of crop field, Faculty of Agriculture Ain Shams University, for his great help during this work.

I am also greatly indebted to Prof. **Dr. Sanaa Abd El Hamead**. Senior researcher of Regional Center for Food and Feed, Agricultural Research Center; for her supervision, and continuous help during carrying out this research work.

My grateful thanks to my Colleagues in Regional Center for Food and Feed, and every one helped me to complete this work. I am also thank my family, my friend's for their support and encouragement during this work period, and I dedicated this work to my family.

CONTENTS

LIST OF TABLES

LIST OF ABBREVIATION

ABBREVIATION		Mean
BV	:	Biological value
CYS/ TSAA %	:	Cysteine / Total sulfur amino acids ×100
EAAI %	:	Essential amino acid index
LEU/ISO	:	Leucine / isoleucine
NI	:	Nutritional index
NTW	:	Normal Seeds using tap water
NTW 1000	:	Normal tap water Sodium chloride(NaCl)1000 PPM
PER	:	Protein efficiency ratio
SBSS	:	solution barley after sterilized and sprouting
SBSS(25G+75B)	:	Solution barley after Sterilized and sprouting (25 % Glycyrrhiza and 75% solution barley)
SBSS(50G+50B)	:	Solution barley after Sterilized and sprouting (50% Glycyrrhiza and solution barley 50%)
SBSS1000	:	Solution barley after Sterilized and sprouting using tap water NaCl 1000 ppm
SDW	:	Sprout dry weight
SFW	:	Sprout fresh weight
SHL	:	Sprout hypocotyl length
SHW	:	Sprout hypocotyl weight
SL	:	Sprout Length
SRL	:	Sprout radical length
SRW	:	Sprout radical weight
SSL	:	Sprout shoot Length
SSW	:	Sprout shoot weight
STW	:	Sterilization Seeds Sprout tap water
STW 1000	:	Sterilized tap water Sodium chloride(NaCl)1000 ppm
TAA	:	Total Amino Acids
TAAA	:	Total Acids amino acids
TBAA	:	Total Basic amino acids
TCAA	:	Conditionally Amino Acids

TDS	:	Total dissolved solids
TEAA	:	Total Essential Amino Acids
TEAA/ TAA %	:	Total Essential Amino Acids / Total Amino Acids ×100
TEAA/TNAA%	:	Total Essential Amino Acids / Non-Essential Amino Acids
TNAA	:	Total Neutral amino acids
TNEAA	:	Non-Essential Amino Acids
TSAA	:	Total sulfur amino acids
TSAA/ TAA %	:	Total sulfur amino acids / Total Amino Acids ×100
TW (25G+75B)	:	Normal tap water (25% Glycyrrhiza +75% solution barley)
TW (50B+50B)	:	Normal tap water (50% Glycyrrhiza +50% barley)
TW 1000 (25G+75B)	:	Normal tap water Sodium chloride(NaCl)1000 (25% Glycyrrhiza +75% barley)
TW 1000 (50B+50B)	:	Normal tap water Sodium chloride(NaCl)1000 ppm (50% Glycyrrhiza +50% barley)

INTRODUCTION

As Egypt population increases rapidly and it is consider one of the main constraints for limiting land, water and food resources, it's more important to define accurately the amount and quality of protein required to meet human nutritional needs. From nutritional point of view, clover or alfalfa sprouts are considered as a high quality for the health, due to its rich nutritional profile (>50 % protein) (**Cairney 1997 and Abdallah 2008**).

Clover was first cultivated thousands of years ago in Egypt before pyramid building **(Jones *et al.*, 1982 and Abdallah (2008)** reported that seed germination and production of sprouts is an old habit that was adapted 3 days of sprouting to be the optimum period for clover growing in the dark to produce etiolated sprouts. Clover sprouts are the most common usually eaten raw in salads, therefore its recommends that, prior to sprouting, seeds be disinfected by washing in solution of 2% calcium hypochlorite ($CaCI_2O_2$) **(Lang *et al.*, 2000).**

In arid and semi-arid areas, salinity is the most serious a biotic stress that effects plant morphology and physiology through osmotic and ionic stress and changes biochemical response in plant **(Khan *et al.*, 2013).** Plants can resist osmotic stress by increasing the size of root system or reducing leaf area **(Guo *et al.*, 2002; Han and Wang, 2005; Irigoyen *et al.*, 1992).** The higher level of salinity decreased alfalfa seed germination with non-uniform emergence **(Yang, 2001).** Plants resist osmotic stress also by changing physiological and biochemical process such as antioxidant defense systems, solute accumulation, etc. **(Rogers *et al.*, 1995; Hasegawa *et al.*, 2000, Hsiao and Xu, 2000 and Ibrahim *et al.*, 2017)**. Moreover, during sprouting the water soluble protein content increased, but the salt soluble protein fraction decreased **(Wanasundara *et al.*, 1999).**

INTRODUCTION

Albumins are water-soluble proteins, whereas globulins are salt (NaCl)-soluble proteins, and both were the major protein fractions, followed by storage proteins, glutelin (are organic solution – soluble proteins) in both wheat and barley seeds **(Xue Zhu *et al.*, 2006 and Kumar and Matta, 2011).** During barley seed germination albumins and globulins degraded faster, while glutelin and prolamin fractions were not seen degradation products **(Kumar and Matta, 2011).**

Biogenic amines (B.A) are basic nitrogenous compounds formed mainly by decarboxylation of amino acids or by amination and transamination of aldehydes and ketones **Askar, (1986).** In virtually all foods that contain protein or free amino acids and are subject to conditions enabling microbial or biochemical activity biogenic amine can be expected**.** Biogenic amines contains proteins, enzymes, cofactors, water, salt, and bacteria, and therefore represents an ideal environment for BA production from free amino acids by decarboxylating enzymes of microorganisms during ripening **(Novella-Rodriquez *et al.*, 2000)**. In non-fermented foods, the presence of biogenic amines above a certain level is considered as indicative of undesired microbial activity, of microbial spoilage. However, the presence of biogenic amines in food does not necessary **(Santos. *et al.*, 1985.; Vidal-Carou , *et al.*, 1990 and Silla Santos 1996).**

Many researchers were studied the nutritional value of wheatgrass juice and it health benefit (**shirude, 2011; Rana *et al.*, 2011 and Dina anwar *et al.*, 2015**). It was reported that wheatgrass can be traced back in history over 5000 years, to ancient Egyptian and perhaps even early Mesopotamian. It is purported that ancient Egyptians found sacred the young leafy blades of and prized them for their positive effect on their health and vitality. Wheat grass can extracts for consume by two different types like squeezed or chewed then throw out. Wheat grass has quickly become “the new age espresso” offered in smoothies and juices, salads, and even in powders and tablets and is one of the cereal grasses mostly

used as a health drink. **(Ben- Arye *et al*., 2002).** However, no information can be seer about the nutrition value of barley sprout juice.

Present investigation were under taken for determine the changes occurring in four protein fractions during sprouting of clover seeds using saline water and investigator the protein quality and chemical composition of clover sprout and barley sprout juice The outcomes of this study would be important for preventing protein energy malnutrition in Egypt and for etiolated clover sprouts potential application as functional food ingredients.