

UTILIZATION OF GRAPE PROCESSING WASTES IN SOME CHICKEN PRODUCTS

By

ZEINAB MOHAMED HASSAN AHMED

B.Sc. Agric. Sci. (Food Technology), Ain Shams University, 2005

**A Thesis Submitted in Partial Fulfillment
Of
The Requirement for the Degree of**

**MASTER OF SCIENCE
in
Agricultural Sciences
(Food Science and Technology)**

**Department of Food Science
Faculty of Agriculture
Ain Shams University**

2019

Approval Sheet

**UTILIZATION OF GRAPE PROCESSING WASTES
IN SOME CHICKEN PRODUCTS**

By

ZEINAB MOHAMED HASSAN AHMED

B.Sc. Agric. Sci. (Food Technology), Ain Shams University, 2005

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

Dr. Abdel-Aziz Nadir Shehata Mohamed

Researcher Prof. Emeritus of Food Science and Technology, National
Research Center

Dr. Yosry Ahmed Abd El-Daim

Prof. of Food Science and Technology, Faculty of Agriculture, Ain
Shams University

Dr. Abdel Fattah Abdel Kareem Abdel Fattah

Associate Prof. of Food Science and Technology, Faculty of
Agriculture, Ain Shams University

Dr. Mohamed Farag Khallaf

Prof. Emeritus of Food Science and Technology, Faculty of
Agriculture, Ain Shams University

Date of Examination: / / 2019

UTILIZATION OF GRAPE PROCESSING WASTES IN SOME CHICKEN PRODUCTS

By

ZEINAB MOHAMED HASSAN AHMED

B.Sc. Agric. Sci. (Food Technology), Ain Shams University, 2005

Under the supervision of

Dr. Mohamed Farag Khallaf

Prof. Emeritus of Food Science and Technology, Department of Food Science, Faculty of Agriculture, Ain Shams University, (Principal Supervisor)

Dr. Abdel Fattah Abdel Kareem Abdel Fattah

Associate Prof. of Food Science and Technology, Faculty of Agriculture, Ain Shams University

Dr. Atef Saad Osheba

Head Prof of Meat and Fish Technology Dept., Food Technology Research Institute, Agricultural Research Center, Giza

ABSTRACT

Zeinab Mohamed Hassan Ahmed “Utilization of Grape Processing Wastes in Some Chicken Products”. Unpublished M.Sc. Thesis, Department of Food Science, Faculty of Agriculture, Ain Shams University, 2019.

In this study, ethanol (50 and 100%), methanol (70 and 100%), acetone (70 and 100%), chloroform 100% and water extract of grape seeds were evaluated for their antioxidant and antimicrobial activities. Extraction yield of grape seeds ranged from 6.0 to 14.50% depending on organic solvent type. Grape seed methanol 70% and ethanol 50% extract had significantly higher total phenolic (9.501 and 8.949 mg gallic acid/g), total flavonoids (6.707 and 6.398 mg quercetin /g) and antioxidant activity (702.37 and 636.50 $\mu\text{MolTrolox eq/gm}$), respectively than other grape seed extracts. While, grape seeds water extract showed the lowest total phenolic, flavonoids compounds and antioxidants activity. Twenty one phenolic and nine flavonoid compounds were identified by HPLC technique in each one of grape seed extracts. P-OH-benzoic was the highest phenolic compound in GS methanol 70% extract. Pyrogallol was the highest phenolic compound in GS ethanol 50% extract. Alpha-coumaric and cinnamic were present in trace amount in grape seed methanol 70% and ethanol 50% extract, respectively. Moreover, hesperidine was the major flavonoid compound in all grape seed extracts followed by naringin, rutin and quercetrin. Also, 50% grape seeds ethanol extract had higher antimicrobial activity against all studied microorganisms. Grape seed extracts could be arranged in descending order according to their antimicrobial potency as: ethanol 50% > acetone 50% > ethanol 100% > acetone 100% > methanol 70% > chloroform 100% > water. Grape seeds ethanol 50% extract was selected for improving the quality attributes and shelf-life of chicken fillets and chicken burgers during storage at $5\pm 1^\circ\text{C}$. Soaking of chicken breast fillets in different concentrations of grape seeds ethanol extract for other chicken fillets samples led to increase moisture content and decrease

crude protein, crude fat and total ash contents. By increasing cold storage period, moisture and crude protein contents significantly decreased but crude fat, total ash, total volatile nitrogen and thiobarbituric acid of both chicken fillets and chicken burgers were significantly increased. Moreover, water holding capacity, plasticity and cooking parameters of chicken breast fillets and chicken burgers were improved by soaking chicken fillets in different concentrations of GSEE during cold storage. Chicken fillets treated with different concentrations of GSEE and stored at $5\pm 1^{\circ}\text{C}$ for 16 days had lower total bacteria psychrophilic bacteria, *Staphylococcus aureus*, coliform bacteria, and total yeast and mold counts. Also, burgers treated with GSEE were lower in total bacterial, psychrophilic bacteria and yeast and mold counts than control sample. The microbial count of chicken breast fillets and chicken burgers were decreased by increasing GSEE concentration. All chicken breast fillets samples whether untreated or treated with various concentrations of grape seeds ethanol extract were completely free from *Salmonella spp.* either at zero time or along cold storage period. Also, all chicken burgers were completely free from coliform bacteria, *Staphylococcus aureus* and salmonella *spp.* either at zero time or during cold storage period. Moreover, soaking of chicken breast fillets in different concentrations of GSEE led to significant ($p\leq 0.05$) improvement in taste, odor and color immediately after processing and during cold storage period. While, texture and overall acceptability were slightly improved. Chicken fillets treated with 0.3% GSEE and burger sample treated with 0.5% GSEE had higher overall acceptability immediately after processing and during cold storage periods.

Key words: Grape seeds, Extractions, Antioxidant activity, Antimicrobial activity, Chicken fillets, Chicken burger, Chemical, Physical, Microbiological properties and Organoleptic evaluation.

ACKNOWLEDGMENT

All praises are due to Allah, who blessed me with those kind professors and colleagues, who support me to produce this thesis.

I would like to express my deep grate gratitude to my supervisor **Prof. Dr. Mohamed Farag Khallaf**, Prof. of Food Science and Technology, Department of Food Science, Faculty of Agriculture, Ain Shams University, for his supervision, guidance, patience, incredible and valuable assistance, continuous encouragement, valuable as well as and constructive comments.

Deep thanks and appreciation to **Dr. Abdel Fattah Abdel kareem**, Associate Prof. of Food Science and Technology, Department of Food Science, Faculty of Agriculture, Ain Shams University; for his advice and meticulous observation throughout the work.

I am greatly indebted to **Prof. Dr. Atef Saad Osheba**, Prof. and Head of Meat and Fish Technology Dept., Food Technology Research Institute, Agricultural Research Center, Giza, for this study, his continuous supervision and for the extremely good research and aid facilities. He supported me with constructive supervision, valuable discussion and criticism throughout the course of this thesis.

I gratefully acknowledged the all staff members of the Department Food Science, Faculty of Agriculture, Ain Shams University, for their support and personal encouragement, valuable helps and the research and technical staff of Meat and Fish Technology Dept., Food Technology Research Institute, Agricultural Research Center, Giza, for their assistance. I fail to express my appreciation to my family for their support and help me through my life and my study, as well as to my husband and my lovely daughter Malak.

CONTENTS

	Page
LIST OF TABLES.....	VI
LIST OF FIGURES.....	IX
LIST OF ABBREVIATIONS.....	XI
1. INTRODUCTION.....	1
2. REVIEW OF LITERATURE.....	3
2.1. Grapes and their seeds	3
2.2. Poultry meats	5
2.3. Antioxidative properties of grape seeds	7
2.4. Antimicrobial activity of grape seeds	11
2.5. Use of grape seed extracts in fleshy products.....	14
3. MATERIALS AND METHODS.....	23
3.1. MATERIALS.....	23
3.1.1. Grape pomace	23
3.1.2. Chicken meat	23
3.1.3. Texturized soy.....	23
3.1.4. Spices mixture	23
3.1.5. Other ingredients used in burger preparation.....	23
3.1.6. Microbial cultures.....	23
3.2. METHODS.....	24
3.2.1. Technological methods	24
3.2.1.2. Preparation of grape seed extracts	24
3.2.1.2. Preparation of different concentrations grape seeds ethanol 50% extract.....	24
3.2.1.3. Preparation of chicken breast fillets samples.....	24
3.2.1.4. Preparation of chicken burger samples.....	25
3.2.2. Analytical methods.....	25
3.2.2.1. Chemical analysis.....	25
3.2.2.2. Determination of total phenolic content (TPC) for grape seed extracts.....	25

	Page
3.2.2.3. Determination of total flavonoids for grape seed extracts.	26
3.2.2.4. Fractionation of phenolic and flavonoids compounds by HPLC.....	26
3.2.2.4.1. Fractionation and identification of phenolic compounds.	26
3.2.2.4.2. Fractionation and identification of flavonoids compounds	26
3.2.2.5. Antioxidant activity of grape seed extracts.....	27
3.2.2.6. Total volatile nitrogen (T.V. N).....	27
3.2.2.7. Thiobarbituric acid value (T.B.A)	27
3.2.2.2. Physiochemical and physical analysis.....	28
3.2.2.2.1. The pH value.....	28
3.2.2.2.2. Water holding capacity and plasticity	28
3.2.2.2.3. Cooking loss	28
3.2.2.2.4. Shrinkage	29
3.2.2.3. Microbiological examinations.....	29
3.2.2.3.1. Antimicrobial activity of grape seed extracts.....	29
3.2.2.3.2. Enrichment of microbial cultures.....	29
3.2.2.3.3. Preparation of grape seed extracts.....	30
3.2.2.3.4. Paper Disc Plate method	30
3.2.2.3.5. Microbial load of fresh chicken breast fillets and chicken burgers.....	30
3.2.2.3.6. Bacteriological methods.....	35
3.2.2.3.6.1. Total bacterial count and psychrophilic bacteria	35
3.2.2.3.6.2. Coliform bacteria.....	35
3.2.2.3.6.3. <i>Staphylococcus aureus</i> count.....	35
3.2.2.3.6.4. Detection of <i>Salmonella spp</i>	35
3.2.2.3.6.5. Yeast and mold counts.....	36
3.2.2.4. Organoleptic evaluation	36
3.2.2.5. Statistical analysis.....	36
4. RESULTS and DISCUSSION.....	37
4.1. Proximate composition of chicken breast meat and grape seeds	37
4.2. Extraction yield of grape seeds as affected by organic solvents.	38

	Page
4.3. Total phenolic, total flavonoids and antioxidant activity of grape seeds.....	41
4.4. Quantification of individual phenolic compounds of grape seed extracts by HPLC technique.....	43
4.5. Quantification of individual flavonoids compounds of grape seed extracts by HPLC technique.....	49
4.6. Antimicrobial activity of grape seed extracts.	51
4.6.1. Antimicrobial activity of grape seed ethanolic extracts.....	52
4.6.2. Antimicrobial activity of grape seed methanolic extracts.....	55
4.6.3. Antimicrobial activity of grape seed acetone extracts	58
4.6.4. Antimicrobial activity of water and chloroform grape seed extracts	61
4.7. Chicken breast fillets.....	64
4.7.1. Chemical composition of chicken breast fillets.....	64
4.7.1.1. Moisture content.....	64
4.7.1.2. Crude protein content	67
4.7.1.3. Crude fat content	70
4.7.1.4. Total ash content	72
4.7.2. Chemical and physiochemical properties of chicken breast fillets	75
4.7.2.1. The pH values of chicken breast fillets.....	75
4.7.2.1. Total volatile nitrogen	77
4.7.2.2. Thiobarbituric acid (TBA).....	80
4.7.3. Physical quality attributes of chicken breast fillets	83
4.7.3.1. Water holding capacity.....	83
4.7.3.2. Plasticity of chicken breast fillets.....	85
4.7.3.3. Cooking loss	87
4.7.4. Microbiological evaluation of chicken breast fillets.....	89
4.7.4.1. Total bacterial count.....	89
4.7.4.2. Psychrophilic bacterial count.....	92
4.7.4.3. <i>Staphylococcus aureus</i> count.....	94

	Page
4.7.4.4. Coliform bacterial counts.....	95
4.7.4.5. <i>Salmonella spp.</i> Bacteria.....	98
4.7.4.6. Yeasts and molds counts.....	99
4.7.5. Sensory properties of chicken breast fillets	101
4.7.5.1. Taste	101
4.7.5.2. Odor	103
4.7.5.3. Color	105
4.7.5.4. Texture	106
4.7.5.5. Overall acceptability	108
4.8. Chicken burger.....	109
4.8.1. Chemical composition of chicken burger.....	109
4.8.1.1. Moisture content.....	109
4.8.1.2. Crude protein content	112
4.8.1.3. Crude fat content	114
4.8.1.4. Total ash content	117
4.8.1.5. Total carbohydrates content	119
4.8.2. Chemical and physiochemical properties of chicken burger	121
4.8.2.1. The pH values of chicken burger	121
4.8.2.2. Total volatile nitrogen	123
4.8.2.3. Thiobarbituric acid (TBA)	125
4.8.3. Physical quality attributes of chicken burger.....	127
4.8.3.1. Water holding capacity	127
4.8.3.2. Plasticity of chicken burger.....	129
4.8.3.3. Cooking loss of chicken burger samples.....	131
4.8.3.4. Shrinkage of chicken burger	133
4.8.4. Microbiological evaluation of chicken burger.....	135
4.8.4. 1. Total bacterial count.....	135
4.8.4. 2. Psychrophilic bacterial count.....	137
4.8.4. 3. Coliform, <i>Staphylococcus aureus</i> and <i>Salmonella spp.</i>	139
4.8.4. 4. Yeasts and molds counts.....	140
4.8.5. Sensory properties of chicken burger	143

	Page
4.8.5.1. Taste	143
4.8.5. 2. Odor	145
4.8.5.3. Color	147
4.8.5.4. Texture	148
4.8.5.5. Overall acceptability	150
5. SUMMARY	152
6. REFERENCES.....	170
ARABIC SUMMARY	