EVALUATION OF *CHENOPODIUM QUINOA* WILLD AS A NEW FORAGE CROP UNDER EGYPTIAN CONDITION

By

ABDALLAH MASOUD ELSAYED MASOUD

B.Sc. Agric. Sc (Animal production), Ain Shams University, 2011

A thesis submitted in partial fulfillment
Of
The requirements for the degree of

MASTER IN AGRICULTURE SCIENCE

(Animal Nutrition)

Department of Animal production
Faculty of Agriculture
Ain Shams University

2016

Approval Sheet

EVALUATION OF *CHENOPODIUM QUINOA* WILLD AS A NEW FORAGE CROP UNDER EGYPTIAN CONDITION

By

ABDALLAH MASOUD ELSAYED MASOUD

B.Sc. Agric. Sc (Animal production), Ain Shams University, 2011

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

Dr. Mohamed Ahmed Hanafy ……..……
Prof. Emeritus of Animal Nutrition, Faculty of Agriculture, Cairo University

Dr. Hamdy Mohammad Khattab …….
Prof. Emeritus of Animal Nutrition, Faculty of Agriculture, Ain Shams University

Dr. Etab Ramadan Abd El-Galil …….....….
Associate Prof. of Animal Nutrition, Faculty of Agriculture, Ain Shams University.

Dr. Nasr El -Sayed Yehia El-Bordeny ……
Associate Prof. of Animal Nutrition, Faculty of Agriculture, Ain Shams University

Date of Examination: / / 2016

EVALUATION OF *CHENOPODIUM QUINOA* WILLD AS A NEW FORAGE CROP UNDER EGYPTIAN CONDITION

By

ABDALLAH MASOUD ELSAYED MASOUD

B.Sc. Agric. Sc (Animal production), Ain Shams University, 2011

Under the supervision of:

Dr. Nasr El -Sayed Yehia El-Bordeny

Associate Prof. of Animal Nutrition, Dep. of Animal Production, Faculty of Agriculture, Ain Shams University. (Principal Supervisor).

Dr. Etab Ramadan Abd El-Galil

Associate Prof. of Animal Nutrition, Dep. of Animal Production Faculty of Agriculture, Ain Shams University.

Dr. Sayed Shaban Eisa

Prof. of Potany, Faculty of Agriculture, Dep. Of Botanay, Ain Shams University.

ABSTRACT

Abdallah Masoud El Sayed Masoud: Evaluation of *chenopodium quinoa* willd as a new fodder crop under Egyptian condition. Unpublished M.Sc. Thesis, Department of Animal production, Faculty of Agriculture, Ain Shams University, 2016.

This study aimed to evaluate the productivity, chemical composition of *chenopodium quinoa* willd as well as In vitro and In vivo evaluation of inclusion quinoa hay in lambs ration. Two seed types of *Chenopodium quinoa* Willd .cv. Hualhuas and CICA were cultivated at two different locations (non saline soil and saline soil).At harvest stage, plant from one square meter in the central of each plot were cut at ground level and productivity was determined. *In vitro* evaluation of quinoa hay was applied on two steps the first was to evaluate the feeding value of *Chenopodium quinoa* willd plant as a single source of feed in comparison with clover hay, where the two stage in vitro technique was applied and the second was to evaluate effect of substituting clover hay with quinoa hay in ruminant rations, where the one stage *In vitro* technique developed was applied. The best substituting level of quinoa cultivated under saline soil condition was applied in the growth trial. Which twelve growing Barqi male lambs with mean initial live body weight of 24.58 ±1.34 kg were divided into two similar groups, six animals each. The animals were randomly assigned to receive one of the two rations for 90 day. Feed intake, nutrient digestibility, rumen fermentation parameters, blood parameters, body weight gain and feed conversion were evaluated.

In general, CICA cultivar significantly produced higher forage yield than that obtained from Hualhuas .The maximum forage yield of CICA cultivar recorded under non-saline at summer season. The cultivated quinoa varieties recorded lower OM content and higher Ash, Protein, Ether Extract, natural detergent fiber (NDF) and acid detergent fiber (ADF) contents but lower OM content compared to clover hay. No significant ($P>0.05$) differences were

recorded for In Vitro DM and OM disappearance (IVDMD and IVOMD) for quinoa plants (CICA cultivar) cultivated under salinity condition compared to clover hay.The feed intake as dry matter intake (DMI) and total digestible nutrient intake (TDNI) either as g h^{-1} d^{-1} or g $kg^{0.75}$ d^{-1} was recorded numerically higher value for quinoa group compared to control group. The differences were not significant ($P>0.05$) for both DMI and TDNI as g $kg^{0.75}$ d^{-1}. The animals fed ration containing quinoa hay recorded lower average total bacterial count, total Entodenium and total protozoa count in comparison with the animals fed alfalfa hay as single source of roughage and higher values of ammonia concentration compared to quinoa group at 0, 3 and 6 hrs post feeding as well as the mean values. No significant differences were recorded between the control and quinoa groups in all nutrients digestibility as well as the nutritive values as TDN and DCP. The quinoa group recorded significantly higher serum total protein content compared to control group. While no significant differences were recorded in Albumin Globulin, Cholesterol, ALT, AST, Alkaline phosphates, Urea and Creatinine. Insignificant differences were recorded between the control and quinoa group in final body weight, total gain and average body weight gain. Also non significant differences in the feed conversion as DM, CP and TDN for the control group were observed compared to quinoa group.

It could be used quinoa as a feed for sheep replaced by 50% forage portion in sheep rations.

Key words:

Chenopodium quinoa, productivity, in vitro, growth and digestibility.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

ADF	Acid Detergent Fiber
CF	Crude Fiber
CFM	Concentrate Feed Mixture
CICA	Variety of quinoa
CP	Crude Protein
DCP	Digestible crude Protein
dDM	degraded Dry Matter
DE	Digestible Energy
DM	Dry Matter
DMI	Dry Matter Intake
EE	Ether Extract
FM	Fresh Matter
GE	Gross Energy
IVDMD	*In Vitro* Dry Matter Disappearance
IVOMD	*In Vitro* Organic Matter Disappearance
ME	Metabolizable Energy
NDF	Natural Detergent Fiber
OA	Total soluble oxalic acid
OM	Organic Matter
TDN	Total Digestible Nutrient
TDNI	Total Digestible Nutrient Intake
TVF's	Total Volatile Fatty acids

INTRODUCTION

Expansion of livestock production in Egypt is restricted due to the environmental pressure which; Egypt is characterized as an arid and hyper arid region. Uncultivated land in Egypt desert occupied 96% of the total area and characterized with high evaporation (1500-2400 mm/year) and very low rainfall (5-200 mm/year). Parts of this desert are millions of hectares of coastal sites and salinized farmlands. Under such condition, poor quality and inadequate feed supply have been occurred. However and conventional crops misplace their advantages to reduce the gap between food and feed production and requirements.

Therefore, more efforts have been directed to find alternative food and feed resources under drought and saline condition. An alternative approach has studied to utilize the natural salt-tolerance halophytes for sustainable crop production, particularly for economic interests (food, fodder and fuel) or ecological reasons (soil desalinization, phytoremidation, dune fixation, CO_2 sequestration) **(Reddy *et al*., 2008; Eid and Eisa, 2010; Koyro e*t al*., 2011 and Ladeiro, 2012)**.

Chenopodium quinoa Willd is a Pseudocereal native to the Andean region of South America. Quinoa grain is an important crop in Latin-American region from Colombia (2°N) to central Chile (40°S) (**Risi and Galwey, 1984 and Jacobsen *et al*., 2003)**. Quinoa has recently gained worldwide attention because of its ability to grow under various conditions. Quinoa as a halophyte species has the ability to cope with salinity levels as high as those present in sea water **(Koyro and Eisa, 2008; Eisa *et al*., 2012; Shabala *et al*., 2012; Shabala *et al*., 2013 and Panuccio *et al*., 2014)**. Also quinoa plant is highly resistance to water scarcity (**Gonzalez *et al*., 2012)**. As well as the Food and Agricultural Organization of the United Nations (FAO) has officially declared that the year 2013 be recognized as "The International Year of the Quinoa. The nutritional value of the quinoa grains is high and the whole plant has been used as a fodder for animals **(Galwey, 1989)**. The crop residues are also used to feed animals and poultry **(FAO, 1994).**

Only few research publications were only found about the evaluation and using quinoa plant in ruminant nutrition. So the objective of the present study is evaluation effect of using quinoa plant in lambs ration on their productive performance and *In vitro* evaluation of Quinoa plants.