

**Formulation and Nutritional Analysis of Ready to Mix Infant Food by Using Quinoa Seed and Whey Protein**

**Dissertation I**

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## CERTIFICATE



This is to certify that **Hawa Ibrahim (Registration No.11713594)** has personally completed M.Sc. dissertation-1 entitled '**Formulation and nutritional analysis of ready to mix infant food by using Quinoa seed and whey protein.**' under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of dissertation-1 has ever been submitted for any other purpose at the university.

The project report is appropriate for the submission and the partial fulfillment of the conditions for evaluation leading to the award of Master of Nutrition and Dietetics.

Date: May, 2018

Place: Phagwara, Punjab (India)

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## DECLARATION

I hereby declare that the work presented in the dissertation report entitled “**Formulation and nutritional analysis of ready to mix infant food by using Quinoa seed and whey protein.**” is my own and original work. The work has been carried out by me at school of Agriculture, Lovely Professional University, Phagwara, Punjab, India; under the guidance of Er. Poorva, Assistant Professor (Food Technology) at school of Agriculture, Lovely Professional University, Phagwara, Punjab, India, for the award of the degree of Master of Science in Nutrition and Dietetics.

Date: May 2018

Place: Phagwara, Punjab (India)  
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**Hawa**

I certified that the above statement made by the student is correct to the best of my knowledge and belief.

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## Introduction

Quinoa is a grain with excellent nutritional value. Quinoa has high concentration of proteins and also it contains all essential Amino acids similarly unsaturated fatty acids and small Glycemic index. Quinoa also contains vitamins, minerals and other useful compounds. Quinoa is gluten-free by nature. Quinoa is simple to cook and has versatility in preparation (Chen, 2015, Tang, 2015, González, 2014, Vega, 2010).

Quinoa is developed worldwide with 250 varieties. Its classification depends upon on the color of the plant and fruits or the plant morphology (Vega *et al*; 2010). The grain of Quinoa has been authorized to be sown in Europe, North America, Asia, and Africa.

Quinoa is one of the natural crops rich in complex carbohydrates, micronutrients, fiber and phytochemicals are being replaced with diets high in carbohydrate and refined carbohydrates and oils. Quinoa is considered that it is one of the most excellent vegetal protein sources as its protein levels are similar to those found in milk and higher than those present in cereals such as wheat, rice and maize. Quinoa has food components that may confirm to be health for human utilization (Jancurová *et al*; 2009). It is mentioned that quinoa has many benefits together with susceptible consumers like children, the elderly, competitor people, and similarly patients those Complain with lactose intolerance, females those Suffering with osteoporosis, anemic patients should also be given and people with insulin defects, similarly is suitable to be given people those effected with dyslipidemia, obesity, and celiac disease since its value such as higher amount of its nutrient content and remedy aspects, free-gluten diet. These aspects are recognized to be connected with the availability of the fiber, and micronutrients, fatty acids, anti-free radicals, and mainly phytochemicals in quinoa and they present quinoa an enormous advantage amongst other cereals according to human food and well-being (Vega-Galvez *et al.*, 2010; Repo-Carrasco-Valencia *et al.*, 2010; Pasko *et al.*, 2010a; Bhargava *et al.*, 2006). Banana, is the main herbaceous vegetable in the world and also is which between the ten most significant crops in Brazil, which is the fourth largest producer in the world at over 7 million tones produced by conventional cultivation systems (IBGE, 2012, RIBEIRO *et al.*, 2012). One aspect of the Brazilian development and mainly due to the country's cultivated quality and similarly is related to the development of its agro-industrial sectors. Like the sugarcane and citrus production complexes also other sectors of socioeconomic importance have been explored with a complete view in order to bring that greater added value to agricultural product and is to be avoid food waste

similarly increase farmers' income, and develop alternative and nutritious food raw material (BORGES et al., 2009).

Banana (*Musa spp.*) is one of the world's most main crops that cultivated in tropical and subtropical areas of the globe. Banana is the most important source of macro-elements, especially potassium and comprises health-good ingredients such as resistant starch, total dietary fibers, rapidly digestible starch and slowly digestible starch. Oligosaccharides which existing in bananas that have found application in the prevention of muscular contractions, regulation of blood pressure and also to be prevented Colon cancer and diabetes and in the cure of intestinal disorders when the banana is unripe(Joshi *et al*; 2014).

Whey protein is a constituent of milk and similarly co-product of cheese-making and casein making in the dairy industry. currently whey is accepted as a value-added ingredient in many food products. Whey and whey components are viewed as value-added ingredients in infant formulas and in addition sports nutrition foods and beverages and further food products. Recognition of whey as a source of diverse biologically active compounds with unique physiological and functional attributes provides opportunities for the food industry to develop functional foods or foods that have potential health benefits. Whey-derived bioactive components have antimicrobial and antiviral properties, and enhance immune defense and bone health, and improve ant oxidative activity, and help keep up against cancer and cardiovascular disease and enhancetheperformance of physically active individuals among other benefits. The present review is an attempt to cover scientific aspects of whey proteins' health benefits and critique some of the important research findings are also related with them to date. Studies show that achieving and maintaining a healthy weight can add years to your life and help avoid weight related complications including diabetes, cancer and heart disease. Diet plays a key role in any weight management program and adding whey protein often helps make a positive variation. Whey protein is a good choice for diabetics who need to carefully manage food intake. It has potential as an added component in dietary plans and in functional foods designed for the control of appetite and body weight and in the management of the metabolic consequences of excess body fat. It has potential as physiologically functional food component for persons with obesity and its co-morbidities (hypertension and type II diabetes, hyper-and dyslipidemia) (Luhovyy *et al*; 2007). It is the best protein for fat loss during energy controlled diet Whey proteins are separated and also sanitized by using several techniques to gain those different concentrations of whey proteins. Whey protein offers high level of branched and necessary chain amino acids. In addition to these whey protein is rich in minerals and vitamins. This protein provides the different advantages to the persons of different applications like sports and Similarly used for cancer treatment athletes, etc.(jangale *et al*; 2013).

## Review of Literature

Quinoa is a cereal crop which has a higher content of protein and it composes an increased antioxidant so that it acts as scavengers of free radical in the human body. In addition, quinoa enhances food quality and contributes to health status of community. Similarly, quinoa consists of high amount of vitamins (including vitamin C and thiamin) and mineral. Quinoa is a plant species of the chenopodiaceous family- Quinoa (*Chenopodium quinoa* Wild.) is a plant species of the Chenopodiaceous family, which originated in the Andean region and can adapt to different types of soil and climatic conditions. It is a pseudo grain with high nutritional value as it is rich in proteins, lipids, fiber, vitamins, and minerals, and has an extraordinary balance of essential amino acids. Quinoa also contains a high amount of health-beneficial phytochemicals including siphoning, phytosterols, and phytoecdysteroids. It is known that quinoa has considerably positive effects on metabolic, cardiovascular, and gastrointestinal health in humans. even with all these health benefits quinoa is not extensively consumed due to several reasons, such as high of their importation costs of the grain and lack of knowledge regarding its benefits among consumers (Navruzet al; 2016). Quinoa (*Chenopodium quinoa* Willd.) is an ancient grain crop that originated from the Andean region of South America. Quinoa belongs to the *Chenopodiaceous* family and includes around 250 species and 3,000 varieties conserved in germplasm banks (Ludena et al; 2017). Quinoa has an extreme agro-ecological adaptability: It can be cultivated both in cold, highland climates, and in subtropical conditions; from sea level to above 4000 m of altitude. Quinoa has botanical name *Chenopodium quinoa* Willd(Miranda et al., 2012; Repo-Carrasco, Espinoza, & Jacobsen, 2003).

**These product are used for baby food estimation and enhancing the capacity of the baby’s nutritional status in order to get well-being and health of the baby**

Name of research paper	Test product taken	Reference
Quality assessment of baby food made of different pre-processed	1.organic acid 2.carotenoid 3.volatil compound	(kathrinet,,al 2015)
Formulation and nutritional evaluation of weaning food processed from cooking banana, supplemented with	1.carbohydrate 2.calorie 3.fatty acids	(Francisca et, at 2013)

cowpea and peanuts.	4sugars	
Evaluation of shelf life of fruit baby food	1.shelf life estimation 2. Sensory analysis 3.DPPH determination	(Prchalova et.al 2016)

**Medical properties of Quinoa:**

Quinoa helps to decrease weight, and similarly improve lipid profile and develops the capacity to reply to oxidative stress.( Thomas *et al*:2015)

**Nutritional facts of quinoa (Semra et al; 2016)**

Composition	Value
Energy	368 kcal
Protein	14.12 gm.
Carbohydrate	64.16 gm.
Fats	6.07 gm.
Ash	2.7 gm.
Fiber	7.0 gm.

Banana is an important fruit which can be act as an antioxidant since it is rich in vitamin C and A as many research studies have been shown. There are different types of banana fruit in terms of color such as yellow banana and green banana. Basically, banana is a good for cognitive activation and for hypertension due to have more quantities of potassium. Green bananas in general are absolutely nutritious and it is a good source of fiber (Suntharalingam *et al*; 1993),



resistant starch (Faisant *et al*; 1995), vitamin A (Englberger *et al*; 2003), vitamin B6 (Li S *et al*; 2002), vitamin C (Suntharalingam *et al*; 1993) and potassium (Suntharalingam *et al*; 1993). Banana powder made from dehydrated or naturally dried green banana (such as monthan species) (Suntharalingam *et al*; 1993), are used as

replace flour in many dishes including gluten free dishes (Zandonadi *et al*; 2012). Powder prepared with the banana skin (not peeled), has a higher nutritional content with higher value of minerals, dietary fibers, total phenolics and higher anti-oxidant activity than peeled (Haslinda *et al*; 2009). However, there are significant anti-fungal compounds in banana skins that need to be considered (Prusky *et al*; 1993). The human health implications both positive and negative may require being more nearly assisted when unpeeled bananas are used in foods (Apostolopoulos *et al*; 2017). There are Someof medical properties of banana such as the young leaves of the banana are sitedas the bandages on the burns and other skin disorders.

The roots of the banana are equally administered in gastrointestinal disorders and also dysentery and other ailments , banana seed mucilage can also be given in cases of diarrhea. Antifungal and antibiotic principles are found in the peel and soft tissue of fully ripe bananas. and serotonin are in additiona leexisting in the ripe peel and pulp.Serotoninhinders gastric discharge and stimulates the smooth muscle of the intestines.(Kumar *et al*; 2012)

**Nutritive value of banana powder (Wamono *et al*;2001)**

<b>Composition</b>	<b>Value</b>
Energy(kcal)	2569
Protein %	11.59
Fat %	6.48
Vitamin B6( mg)	2.2
Vitamin C (mg)	2.89
Folate( Mcg)	80.7

Whey protein (WP) is a nutritious supplementation obtained from the cheese manufacture and plays a major role in body structure. Whey protein (WP) is a commonly eaten nutritious fortification which contributes to enhance the power and muscle mass during resistance training (RT) regimes. Muscle protein anabolism is extremely elevated following RT which is further enhanced by WP (Davies et al; 2018). Fortunately, Hippocrates already applauded the health properties of whey in Ancient Greece; and throughout the Middle Age, whey was recognized not only as a medicine, but also even as an aphrodisiac and a skin ointment: it was in fact a fixed constituent of salves and remedies to relieve the burns to inspire vitality and to treat the various illnesses (Kosikowski (1982) Madureir (2007). Whey protein consists all 20 amino acids and all nine essential amino acid and it is full of and balanced source of the sulphur amino acids that plays an important role as antioxidants as precursors to the potent intracellular antioxidant glutathione and in one-carbon metabolism (Shoveller *et al*; 2005) The whey protein in addition play an important role while Lactoglobulin can be active to inhibit rather than support allergy while Lactalbumin defends adjacent to infection, directly kills cancer cells when complexed with oleic acid the whey protein similarly improve bone development.

Lactoferrin is a chameleon that enhances immunity to avoid cancer. Obviously the whey protein occurring antibodies exist in milk which combine to the cholesterol in the human digestive tract and avoid its absorption into the bloodstream, Whey proteins slow up angiotensin-I-converting enzyme (ACE) and may have utility in the management of high blood pressure. Whey protein also fight inflammatory diseases similarly cure wound and support bone repair, lower blood pressure and cholesterol, also treat spots (Geoffrey *et al*; 2006).

**Nutritional composition of whey protein powder.**(Jangale et al :2013)

<b>Whey components</b>	<b>Whey powder</b>
Protein	11% to 14.5
Lactose	63% to 75%
Milk fats	1% to 1.5%

## **OBJECTIVES**

- Process optimization for the preparation of baby food.
- Physio-chemical studies of prepared product.
- Nutritional studies of final product.
- Shelf life of the product.

## Material and methods

### Moisture content (%) (AOAC, 2010).

Take 2gm of sample and weigh empty petriplates and then place the sample into the petriplates. After that, keep the sample with petriplates in Hot Air oven at 150°C for 2 hrs. Finally, check the weight till constant weight is obtained.

$$\text{Moisture content \%} = \frac{W_2 - W_1}{W} \times 100$$

$$\text{Moisture content} = \frac{\text{weight of sample before drying} - \text{after drying}}{\text{weight of sample}} \times 100$$

### Ash content:

Weigh 2gm of sample and empty crucible, then get the weight of crucible with sample and burn it till the smoke stopped. After that, keep it into the muffle furnace at 550°C for 6 hours. After that take out the sample with crucible weight and let it cool with the help of desiccator for 10 - 15 mins.

$$\text{Ash content \%} = \frac{\text{weight of crucible + ash} - \text{weight of crucible}}{\text{weight of crucible + sample} - \text{weight of crucible}}$$

### Crude protein content

Digestion method.

Use 0.5 g of sample and measure 3gm of catalyst mixture and add 10ml of H<sub>2</sub>SO<sub>4</sub> and put the mixture in to the Kjeldahl flask.

### Distillation

Take 3ml of boric acid in to conical flask and then add 6 drops of mixed indicator (color should be changed in to green) operate the distillation apparatus.

### Titration

Prepare 0.1N of HCl and pour it in to burete than titrate the distilled sample with HCl

Than color should be turned into pink or red wine

$$\text{Nitrogen \%} = \frac{14 \times \text{normality of acid} + \text{titrate value}}{\text{X100}}$$

Sample weight

Protein (%) = factor (6.25) x N

### **Fat Estimation.**

Measure 2gm of each sample and then put in to the thimble (power form)

After that take the empty Soxhlet beakers and add 80ml of petroleum ether in Soxhlet beaker, then put thimble in to Soxhlet beaker and fix it 80°C for 1 hour and then open the knob

After 1 hour the alarm will ring then close the knob at 1800°C half an hour

Take the beakers and put in to the hot air oven at 100°C for 30min and let the beaker to be cool at about 15 mins and then weight the beaker.

$$\text{Fat \%} = \frac{w_4 - w_1}{w_3 - w_2} \times 100$$

### **Total phenol content (TPC) (AOAC, 2010)**

**Reagents:** Acetone (70%), sodium carbonate (20%), Folin-ciocalteau reagent (1N), PVP (polyvinyl pyridine 10%)

### **Extraction**

Place 0.2gm of powder form of sample in a beaker and 10 ml of 70 per cent of acetone is mixed. Then the beaker was kept in a water bath (set at 37°C for 2hrs). Recurrent stirring was given for further extraction. Afterward finishing of this period, extracted sample was centrifuged for 20 minutes at 3000rpm and watery part was collected in a test tube and was used extra for the analysis of whole and simple phenols.

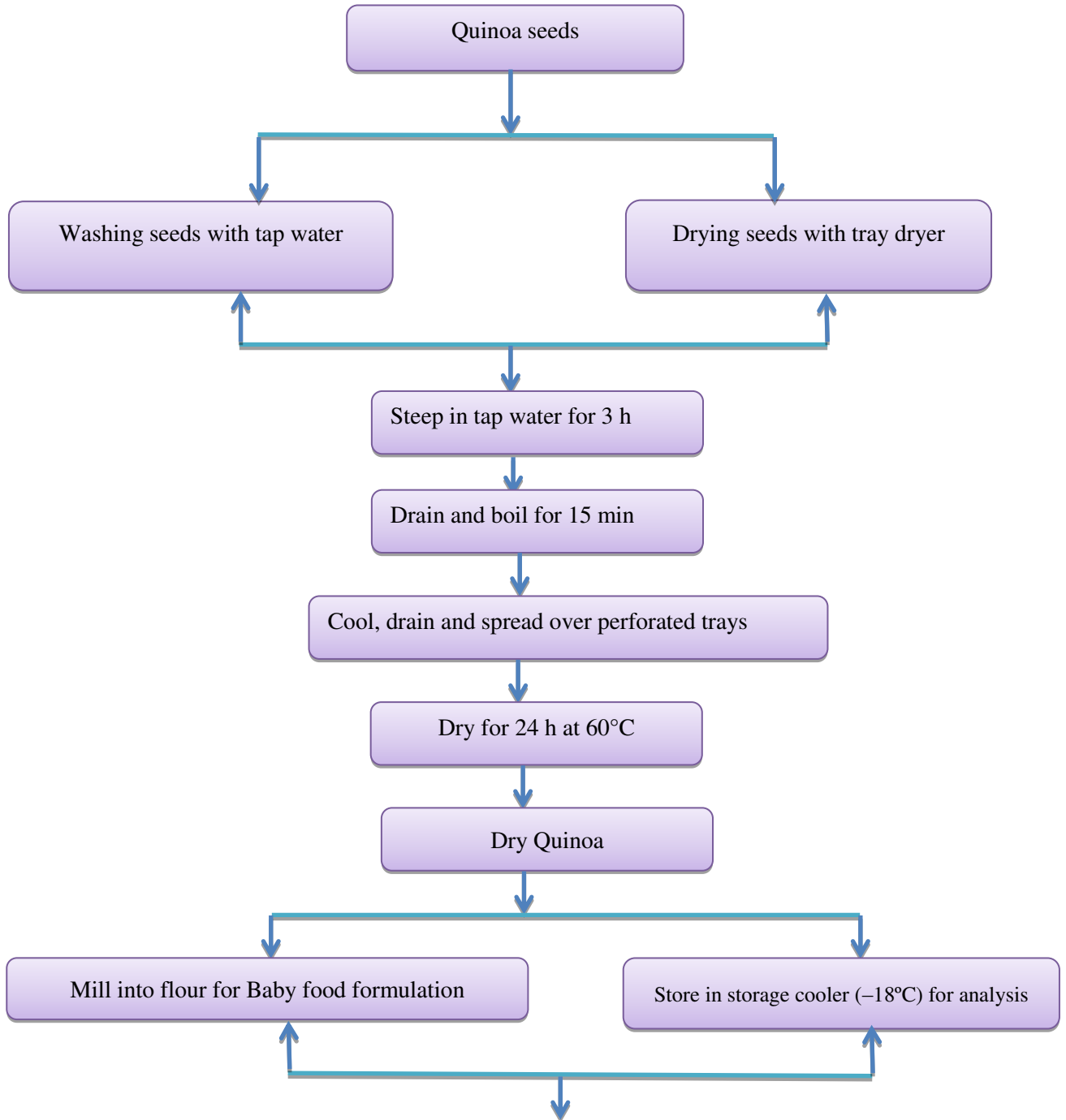
### **Procedure**

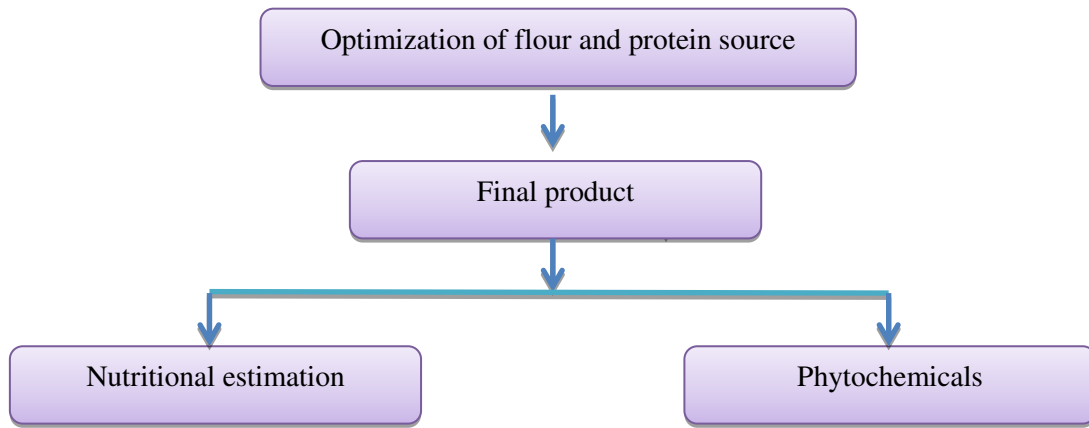
Ali quote extract (0.1) as acquired exceeding was reserved and volume 1ml with distilled water and 2.5ml of 20% of sodium carbonate solution wad added surveyed by 0.5ml of folin-ciocalteau reagent. Contents were left for 40 minutes for color development (purplish blue) Absorbance was read at 725nm after 40 minutes against asuitable blank and calculation were done for total phenols consuming standard curve which was primed using gallic acid (0.1mg/ml).

## **Flavonoids content**

Extraction methods for flavonoids (solvent method, microwave method, enzyme decomposition method, supercritical fluid extraction method, aqueous two phase extraction and ultrasonic extraction method) were summarized, as well as isolation-purification method for flavonoids (column chromatography method, thin layer chromatography method, high-performance liquid chromatography method, paper chromatography method, supercritical fluid chromatography method, macroporous resin adsorption method, high-speed counter current chromatography method, pH grads extraction method, complexation precipitate method, film filtration method and active carbon adsorption method) and determination methods for flavonoids content (spectrophotometric method, high-performance liquid chromatography method, capillary electrophoreses method, supercritical fluid chromatography method, thin layer chromatography method ( Xuefeng et al;2007).

## RESEARCH METHODOLOGY







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