International Journal of Multidisciplinary Research and Development

IJMRD 2014; 1(2): 51-55
www.allsubjectjournal.com
Received: 24-07-2014
Accepted: 29-07-2014
e-ISSN: 2349-4182
p-ISSN: 2349-5979

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Nutrient compositions of raw pork meat and factors affecting the process of fat removal ready for protein hydrolysis to produce functional protein powder

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Abstract
In this research, we conducted a survey of the nutritional ingredients raw pork such as ham moist (75.1 %), protein (22.6 %), lipids (1.71 %), ash (0.5%), vitamin B1 (1.384 mg/100 g); then next stage survey and selection of the solvent, the processing time is suitable for the type of fat; survey the drying time to remove residual solvents exist. Results n-hexane as a solvent is chosen, heat treatment at 80 ^{o}C for 45 minutes and the time required to remove the solvent is 30 minutes drying in 90 ^{o}C. The preliminary survey process the fat in order to create this premise before making optimal protein hydrolysis conditions from lean pork ingredients with enzyme to produce meat protein powder products used as food for feeding patients through catheters.

Keywords: raw pork, nutritional ingredients, solvent, processing time, drying time, protein powder.

1. Introduction

According to Maslow's needs, food and drinking water in the first floor –basic needs" to be justified", General or human beings in particular like to exist then the dining needs is indispensable. With the healthy eating is a daily requirement to maintain for life, activity and development, also for the sick not eating to maintain life and growth, but also helps the body recover, overcome illness. Food contributes in no small part on the resiliency of human disease as well as recovery time is sooner or later. Currently, the nutrition when passers-by to eat were designated most in feeding patients through catheters, they comprise from 54.6% [5] to 86.5% [7].

However most of the products raised soup through the catheter to patients at the hospital were often the hospital themself and have not had the test in terms of quality. So the quality is almost always the question of the treating physician. Several large hospitals used the imported products with very high prices and not all the patient could pay.

In these nutrients are used for patients in protein and animal protein in particular is considered to be the most important source of nutrition. The study to have a common protein production process and consistently produce a product can meet the requirements of nutrition, sanitation, power flow transmission of catheters, and affordable is an urgent request at present. There by contributing to improving the quality of hospitals, protecting the health of patients.

Introducing the development product feed through catheters:
On over the world

Technique of bringing nutrients into the digestive organs not orally had since ancient times; the Greeks were using enema nutrients to maintain health for patients. Ancient Greece physicians have indented porridge, milk, wine, to treat diarrhea. The use of small silver tube from the tip through the esophagus was reported in 1617 to feed for patients suffering from tetanus. Important developments in the matter of providing nourishment through catheters, beginning in the late eighteenth century, 1790 when John Hunter used the catheter made from horn of whales to feed the nervous patients. Nineteenth century European physicians specify retracts the nutrients include beef juice, milk and whiskey. The use of the catheter tip the stomach has been popular since the nineteenth century [3]. In 1942, commercial product feed food through the digestive tract first Nutramigen was brought to market. In 1973, Ensure

product is used first, do not contain lactose and contain multiple nutrients intake intact not hydrolysis was developed in the US. This is a private processing product to feed through the catheter and oral supplements. A few years later, a new development step for these products is when Mead Johnson (Evansville, IN) giving isocal products. Isocal is a standard product and adequate nutrition, isotonic formula specific to feed through the catheter. In 1987, the fiber supplement products only first appeared on the market as Jevity (Abbott Laboratories), contains 14.4 g of soy fiber in 1000 ml, there also are numerous micro-essential, carnitine, taurine minerals such as Mo, Se, Cr [8]. Currently, market the products feed through catheters in the world has quite varied with nearly 200 kinds of commercial products on the market.

In Vietnam

In Vietnam, the products feed through the catheter for the sick remain scant. In the Vietnam market feeding preparations through the catheter has not yet evolved, there are now a number of companies have produced products that feed through the catheter for patients (Enaz powder), food micro nutrient supplementation for patients to eat through the catheter, but the nutritional powder is mainly produced from imported raw materials mixing, and protein in the product is purely vegetable protein. The patient is still mostly used imported products or order processing using the right at home.

In most hospitals, the homemade nutrition diets through gastric tubes artisan caters to patients at the hospital. Popular stew meat, rice, vegetable are general mixing then grinding finely, grounding and using immediately. Although some major hospitals have nutrition works well, there are doctors, engineers, nutritionist knowledgeable about properties to this food processing but have not yet agreed on energy, the less homogenous and high viscosity to impede flows through feeding tubes [6 9]. The quality of the product feed through the catheter is also very limited because not yet calibrated and short storage time (in days) should remain no less patients assigned feed by imported products with a very high price.

Demand of energy and nutrition for patients

Energy demand

Total energy supply to be controlled when offering patients is often defined relative to the energy consumption in order to avoid lack of much energy. With healthy, energy consumption is primarily affected by factors such as age, gender, body size (lean body mass) and physical activity. In the disease, the level of malnutrition and bad not will reduce energy consumption and influence of balance with the increased energy consumption due to the severity of the disease or infection. According to Harris-Benedict allows predicting energy consumption of healthy person is 1 kcal/kg/h (or 4.18 kJ/kg/h) for men's leisure and do not suffer from stress, is adjusted according to world (minus 5-10% for females, according to the degree of stress) [2].

Provides nutritional support to maintain or improve function and avoid lose weight (especially in some body cavity), or recover the body weight and body composition in people with normal nutritional deficiency. Heavy body energy shortage is a matter of concern because it is 30-40% is threatening to life [1]. So the food is fed through the catheter to provide nutritional support to maintain or improve the functioning of the organs and avoid lose weight, make up the restoration of function and normal body weight in people who suffer from lack of nutrition.

Nutritional demand

Carbohydrate

Carbohydrates provide about 40-70% of the energy supplied every day (the current recommendations about 50-55%). Most amount of carbohydrate is digested starch and a fraction (<20%) of the recommendation is the disaccharide (mostly sucrose and lactose) and monosaccharide [2]. The diet has enough carbohydrates would help the body reduce decomposition and concentration of proteins for functional imaging. The role of dietary carbohydrates: energies of the body: each 1 g of powdered sugar provides approximately 4kcal so 365 g with powder sugar in the body, just enough energy to supply approximately one day only. Regulate body activities: carbohydrate metabolism, lipid involvement helps the body metabolize cetonic-acidic, so keep the dielectric constant. Regulate the metabolism of glucose: Glucose needed for nerve cells, neurons can only function normally if the supplied glucose and oxygen in the blood; lack of it will affect nerve cells and lead to brain damage. Furthermore, carbohydrate and fiber supply is made of blocks of larger food thus feeling no, avoid consuming too much energy. Fiber also absorbs harmful substances in the digestive tube such as cholesterol, causing oxidative substances and carcinogens [2].

Protein

Minimum protein needs in diet is estimated at 0.45 g/kg body weight/day. Mature young person needs about 0.75-0.80 g protein/kg body weight. Pregnant women should be given more 6 g of protein daily. During the period of breast-feeding, the total amount of protein recommended adding 17.5 g with pregnant women. When the disease and in the recovery period should protein needs about 1-2 g of protein/kg body weight and 1-1.5 g of protein per kg of body weight in the elderly. The role of protein: energy supply and build the structure for the cell. There are many important biological functions such as: air conditioning, catalytic, protection; transmission of nerve impulses, mobilization and transport of nutrient. If the lack of protein in the diet will adversely affect health such as malnutrition, retardation, decreased immunity; adversely affect many functions of the body such as the liver, nervous system, endocrine glands. Also protein deficiency also made changes to the chemical composition and structure morphology of bones. So the high protein intake and good quality is the demand of the people [2].

Some cases often are used to feed through catheters

-Doctor requires feed through nasal gastric catheter for patients.

-Suffering neurological disorders or psychological disorder that hinders eating orally (tai cerebral, cranial trauma, coma patients for a variety of other causes severe respiratory, breathing air, etc.).

-Not edible due to disorder the most mouth or gullet (esophagus burns), several gastrointestinal deformities, etc.

-Patients with severe burns, unable to eat normally.

-Some intestinal diseases (short bowel syndrome, digestive fistula) [2].

In principle, the feeding solution should fit the position absorbed by the digestive tract. Ordinary people can also use the product feed has been denatured. The main purpose of making the subject is to survey the nutrient content of raw pork and find appropriate conditions for types of fat before the optimization process for the hydrolysis of pork, to shorten the time and increase the efficiency of the process of hydrolysis of meat to produce functional protein powder products.

2. Material and Methods

2.1 Raw material

The pork was purchased from the Vissan limited liability company - branch in Go Vap district (No. 1/1B Thong Nhat, Ward 11, Go Vap district, HCM City, Vietnam) in order to create the stability in terms of nutrient content, ensuring consistent quality standards of raw materials. Fresh meat used meat is experimentally located at the back of the pig as they have high protein, low lipid suitable for processing.

2.2 Research method

2.2.1 Raw material quality evaluation: protein, total lipid, moisture, ash, vitamin B1

2.2.2 Examine the factors influencing the process of fat from raw materials such as

Solvent type, processing time is kind of fat and drying time needed to remove residual solvents remaining. Purpose is to define the types of solvents, while the fat content of the types of fat left in the raw materials is the lowest. And identify appropriate drying time to remove the remaining solvent in the meat. Meat mixed with solvents according to the ratio of 1: 10 and kind of fat by following the hot extraction (i.e. temperature heat is set greater than 10oC solvent's boiling point). Use solvents: chloroform, diethyl ether, n-hexane. Treatment time with solvents is 15-75 minutes. Drying time to remove solvent is 10-50 minutes.

2.3 Analytical methods

- Total protein TCVN 4328 – 1: 2007
- Crude fat: AOAC 920.39
- Moisture content: TCVN 4326 : 2001
- Ash: TCVN 4327 : 2007
- Residual solvent: GC – MS

2.4 Data analysis

All experiments were repeated at least 3 times. Experimental results presented in the research are the average value of the replication. The experimental progress of the error count and analysis of variance ANOVA to determine the difference of the metrics with varying meaning P <0.05, standard error and software Statgraphics aims to test the reliability of the results obtained from these experiments [4].

3. Results and Discussion

3.1 Composition of pork meat

Raw materials are analysed to determine the nutrient content and results are presented in table 1.

Table 1: Nutrient content in raw material pork

Criteria	Content (based on wet matter %)	Content (based on dry matter %)
Moisture content	75.100	-
Protein	22.600	90.763
Crude fat	1.710	6.867
Ash	0.500	2.008
Vitamin B1	1.384 (mg/100g)	-

The meat has high moisture content (75.1%) and nutritious elements easy to microbial infection processing time ingredients z fresh meat must be hurry to avoid going on damaged products. The survey results showed that lean pork have a high protein content accounts for substance intake 90.763 percent dry, relatively high amounts of vitamin B1 1.384 (mg/100 g) is a source of protein, vitamins and suitable for the research work. The material removed most of the lipids (rest 6.867% compared with the volume of dry substance) in order to avoid damage to the process of hydrolysis. At the same time helping to stage the kind of fat left by solvent easier.

3.2 Effect of different solvents for fat removal capability

What kind of different solvent capable of dissolving fat differently depending on the polarization of that solvent. Three types of solvent n-hexane, diethyl ether and chloroform have shown the possibility of extracting fat from different authors, such as: Folch *et al*., 1957 used chloroform: methanol (2:1) in order to extract fat. This is considered the classic method when the fat weight in plant tissues [9]. Hara and Radin 1978 introduced solvent n-hexane: isopropanol (3: 2); Jensen *et al*., 2003 used the solvent diethyl ether combining with isopropanol. According to the results show after dealing with the fat content of the solvent in the dry substance decreases from the initial material 6.867% to 3.1916% for processing the chloroform; 1.4607% for processing diethyl ether and a low of n-hexane 0.8991% (see figure 1). This is explained based on relative polarization of the solvent, the lower the relative polarization that is soluble in fat, the higher the fat content, so the rest of the meat as possible low. Experimental results fully in line with the theory because of the polarization of the solvent diethyl ether, chloroform and n-hexan respectively is 0.009; 0.017 and 0.259. So, n-hexane is chosen as solvent for fat removal in further researches.

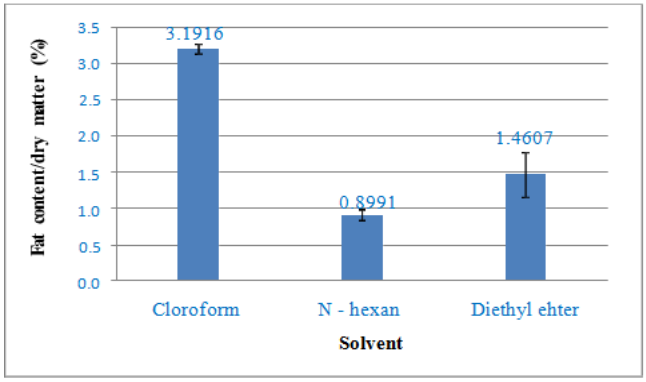

Fig 1: Fat removal by different solvents

3.3 Effect of treatment time by n-hexane solvent to fat removal capability.

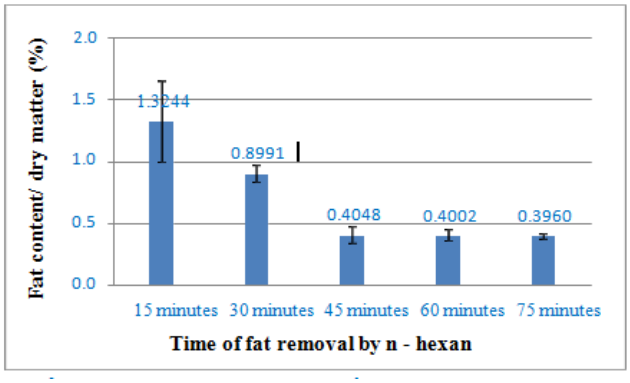

Fig 2: Effect of treatment time by n-hexane solvent to fat removal capability

Treatment time varies, the fat content of meat left in are also different. Processing time the heat decided to kind of fat from the meat because of the longer processing time, the more

solvent conditions exposed flesh because the solvent can dissolve more and more fatty particles. The result shows the fat content of meat left in decline during first, then slows down and do not decrease after 45 minutes. The fat content in the meat is lowest when processing time is 45 minutes and reach 0.4048 ±0.0693% (see figure 2). Meanwhile, increasing processing time up to 60 and 75 minutes, the fat content of meat left in non-steady and do not show statistical differences in reliability 95% of treated in 45 minutes. So, while heat treatment is suitable to fatty type with solvent n-hexane for raw lean meat is 45 minutes.

3.4 Effect of drying time to remove n-hexan residue remaining on meat

The remaining solvent in the flesh if not treated will directly influence the process of hydrolysis and the health of consumers. Thus, the drying period to remove residual solvents exist are essential. Processing temperature is higher boiling point of the solvent in order to ensure full evaporation of the solvent. Drying time decided to the amount of solvent left in the meat (table 2).

Table 2: Effect of drying time to n – hexan residue on meat.

Sample	Area of n – hexan
Standard	**3.39146**
Drying in 10 minutes	16.98183
Drying in 20 minutes	8.10688
Drying in 30 minutes	0
Drying in 40 minutes	0
Drying in 50 minutes	0

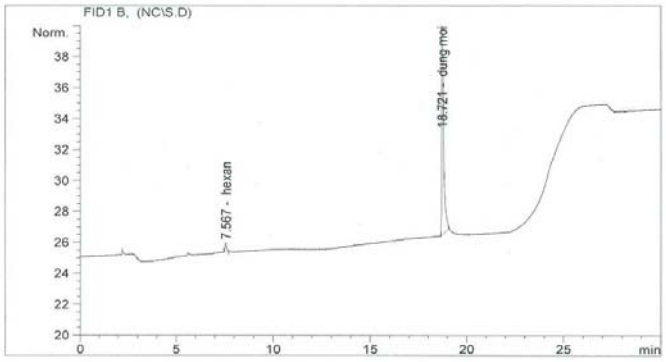

Fig 3: Chromatography of n – hexane standard solution

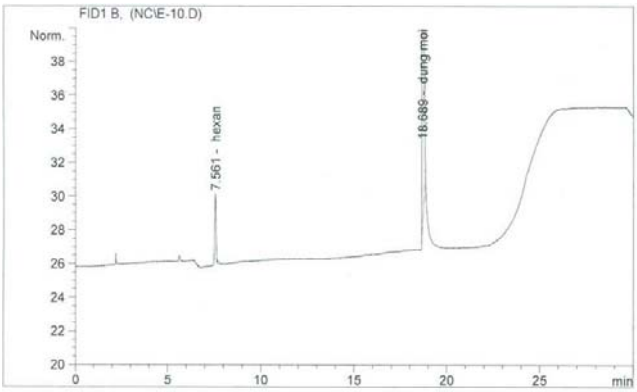

Fig 4: Chromatography of meat after 10 minutes drying

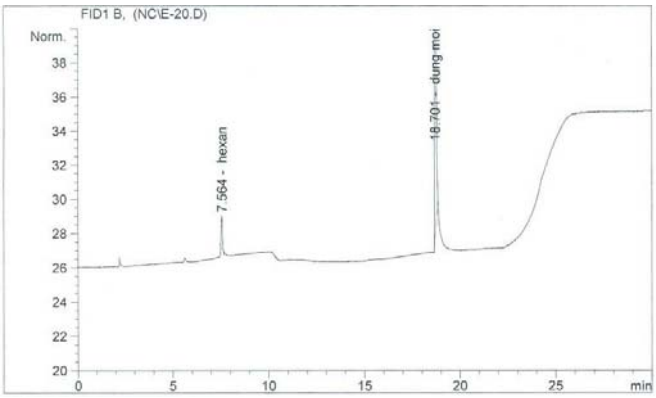

Fig 5: Chromatography of meat after 20 minutes drying

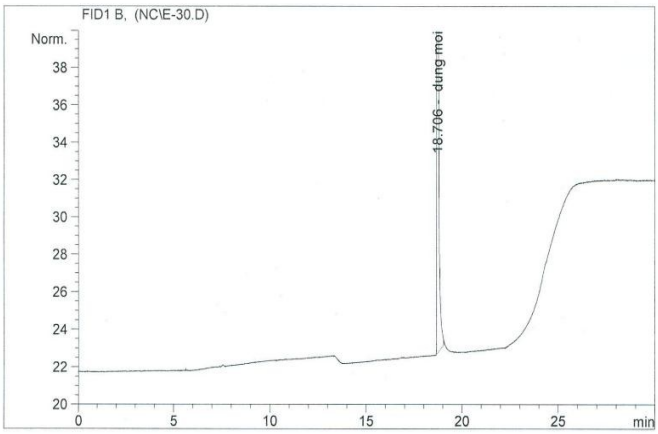

Fig 6: Chromatography of meat after 30, 40, 50 minutes drying

According to Vietnam Pharmacopoeia IV levels of n-hexane allowed in templates is 290µg/g/g mean weight in n-hexane allowing in 1g model was 290 µg/g. From results of running GC-MS showed that correspond to the standard sample of n-hexane has an area of 3.39146. The meat samples can only be used on the condition that an area of n-hexane in this model is smaller than the standard model in n-hexane (see figure 3-5). In the sample of meat drying in different time, then only the drying pattern in 30, 40, 50 minutes is non-existent n-hexane in model and satisfy an area of n-hexane in samples smaller than standard (see figure 6). So the drying time required to sort out the n-hexane extraction of residual meat samples in the reserve after the fat is 30 minutes because when drying at40 and 50 minutes just to spend additional time and costs for the process thermal.

4. Conclusion

The process of choosing of raw material source is fairly stable from Vissan with nutrient content stability, as moisture content (75.1 %), protein (22.6 %), lipid (1.710 %), and ash (0.5 %). This is the initial building method of fat removal. We choose material as lean pork having low fat content. Choosing lean back for fat content results in initial material is low, only about 6.867% (as measured by absolute dry substance) helps the process of researching fat more easily. Parameters of the type of fat that working best are: solvent: n-hexane; meat ratio solvent: 1/10; processing temperature: 80 ^{o}C; duration: 45 minutes; drying time to remove residual solvents available: 30 minutes (in 90 ^{o}C). Pretreatment data on this research in fat removal is the basis for protein hydrolysis to produce functional protein powder for feeding patients through catheters.

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