 ISBN : 978-602-6697-47-9

IMPACT OF DEHYDRATION ON PHYSIC-CHEMICAL PROPERTIES OF YOGHURT AND LACTIC ACID BACTERIA ACTIVITY

ORAL

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ABSTRACT

Dehydration of food is the oldest operations used in food processing or food industry. Food dehydration is reducing moisture of food to low levels for increased shelf life. The yoghurt has rich to ash, also is contains nutrient. It is source of vitamins, phosphorus, potassium, calcium and protein, so considered suitable food for children and adults. It has contains lactic acid bacteria (LAB), that have function of health. Benefits of lactic acid bacteria represented in the lactose digestion, intestinal microflora modulation, cholesterol reduce cancer prevention and immune system stimulation. The yoghurt powder is produced by spray- drying at the optimum conditions, which can prolong a shelf life of it's to 90 days. Freeze-drying and air-drying can be used for dehydrating crispy dehydrated snacks. The freeze-drying lead to very aerated structure, softer final texture, and keeps original colour and flavour of raw materials. The air-drying lead to harder, crispier dried product and Mallard reactions. The freeze drying is suitable for yogurt dehydration because it lower effect on physico-chemical of product.

Keywords*: Yoghurt, Dehydration, Freeze-Drying Air-Drying Spry-Drying.*

INTRODUCTION

Milk is a source of nutritional compounds, water, fat, protein, lactose, minerals, enzymes, vitamins, and dissolved gases (Mourad et al, 2014). the composition of milk depend on several non-genetic factors(Contreras et al. 2015).

Cow's milk has highest percentage for protein, it has important role in human nutrition growth, and development. It has been the lowest fat content associated with digestive and heart problems. Cow milk is rich sources of minerals, vitamins and protein, such as calcium, vitamin D, riboflavin, and phosphorus , potassium, vitamin A, vitamin B12 and niacin (Ajai et al, 2012).

Goat's milk has contained higher amount of magnesium, phosphors and calcium than cow and human milks. It's important for prevention of diseases, and used for stimulation of immunity (Zenebe et al., 2014). Milk of goat has high nutritive value and therapeutic properties as a functional diet for human health (Abbas et al. 2014).

Soybean (Glycine max) is a one of plants leguminous. They are a rich source of good quality protein. Besides nutritional benefits soybeans provide several therapeutic benefits too. Soybean is contains all the major macronutrients required for good nutrition, as well vitamins, minerals, and fiber. in addition, Soybean protein has all the essential amino acids in the amounts needed for human health (Fan et al, 1995). Soy milk have been hypotensive in essential hypertensive patients (Rivas et al. 2002). Soy milk consumption has reduced blood pressure among diabetic patients with nephropathy (Miraghajani et al. 2013). Soybeans is contains almost 40% protein, thus soybeans higher in protein than any other legumes and also many animal products. The composition of soybean seed are affects the soymilk and soy paneer quality and its yield (Poysa, 2002).

Lactic acid bacteria are a large group of bacteria widespread in nature and are beneficial in our digestive systems. They are the most important microorganisms used in food fermentation, contributing to the taste and texture and inhibiting food spoilage (Magdoub et al, 2015). The lactic acid bacteria starter cultures have several health, marketing, and technological advantages (Leroy, and Vuyst, 2004). Lactic acid bacteria in ripening cheese are added as starters and adjunct cultures or originate from the production and processing environments (Blaya et al, 2017). benefits of lactic acid bacteria represented in the lactose digestion, intestinal microflora modulation, cholesterol reduce, cancer prevention and immune system stimulation (Desobry-Banon et al, 1999).

Yoghurt is a fermented food product which is increasing its consumption by year, due to its benefit for human health (Agustini et al, 2017). Yogurts are one of most popular fermented dairy products widely consumed throughout the world (Loveday et al, 2013). The yoghurt has rich to ash, also is contains nutrient. It is source of vitamins, phosphorus, potassium, calcium and protein, so considered suitable food for children and adults (Igbabul et ai, 2014). The total solids content, heat treatment, and incubation temperatures influence the textural properties of yogurts (Lee and Lucey, 2010). Cow and goad yoghurt has antioxidant activity and which is increasing during fermentation

(Rahmawati and Suntornsuk, 2016). If yogurt of cow milk store at 5 °C, It can be safe until 14 days (Supavititpatana et al, 2010). The quality of yoghurt depend on three factors that are; the quality of raw milk, process conditions and starter culture (Paskov et al, 2010).Yoghurt can be mixed with variety of fruits, which are adding variety for the consumers (Kumar and Mishra, 2003). The enriched coconut yoghurt have been a good sensory in most quality attributes, compare with conventional yoghurt (Contreras et al. 2015).

The yoghurt powder produced by spray- drying at the optimum conditions. Which can prolong a shelf life of it's to 90 days by using packing material with lower moisture permeability and by selecting lower storage temperature and relative humidity (Balkir et al, 2011). The aim of this study was carried out to investigate the effect of dehydration on physic-chemical properties of yogurt and lactic acid bacteria activity, and increasing shelf-life of its.

A. Yogurt preparation

The yogurt preparation according to method of (IDF,1987, (Kumar and Mishra, 2003)a, (Kumar and Mishra, 2003)b and (Zhao *et al.*, 2006). Preparation of raw milk with some modifications as follows: Cow's milk (milk fat 3%, total solids 12.3% and acidity 0.17%) was used for yoghurt production and 2% Skimmed milk powder was added to increase solids milk (Ebrahimi Sani and Islami, 2015). The Raw milk sample pasteurization separately at Pasteurization at 80-85 ºC for 30 min or 90-95 ºC for 5 min in stainless steel and cooled to 40ºC. After cooling, starter (*Streptococcus thermophillus, Lactobacillus bulgricus* and *Lactobacillus acidophilus*) were inoculated at concentration of 3%, and incubated at 43 ºC until the ph reached 4.5. (Miao *et al* , 2011).

B. Yoghurt Manufacture

The yoghurt is manufactured according to international standards of yoghurt manufacture IDF standards (IDF,1987), and methods of (Kumar and Mishra, 2003) a, (Kumar and Mishra, 2003)b and (Zhao et al., 2006). The milk is homogenized. And at 80-85 ºC for 30 mints or 90-95 ºC for 5 mints for pasteurization, and then cooled to 45°C. It is then inoculated with 2.5 or 3 present of a mixed lactic starter (2:1 Streptococcus salivarius ssp. Thermophiles, Lactobacillus delbrueckii ssp. bulgaricus), (Streptococcus thermophillus, Lactobacillus bulgricus and Lactobacillus acidophilus).The inoculated milk is incubated to 45°C until a pH of 4.4 was attained in

approximately 4 hours. The temperature increasing when incubation of yogurt, it act on increase viscosity and decreasing in values of ph (Wu and Zhang, 2016). The main processing steps in the manufacturing set and stirred yoghurt showed that in figure 1.

C. Yogurt Coposition

The yoghurt can be categorized into three major varieties, depend on the fat content of yogurt, it called regular yogurt, low-fatyogurt and non-fat yogurt. The regular yogurt is produced from the full fat milk; it should be contain at least 3.25% of milk fat. low-fat yogurt and non-fat yogurt are producing from low fat milk or partially-skim milk, and skim milk sequences (Weerathilake et al, 2014). Yogurt is a dairy product obtained through the fermentation of milk, partly skimmed milk or skim milk by the lactic bacteria Lactobacillus bulgaricus and Streptococcus thermophilus with the lactic bacteria Lactobacillus acidophilus. The composition standards stipulate that yogurt must contain not less than 0.8% lactic acid, not less than 9.5% non-fat milk solids and not less than 3.0% protein. It may also contain some ingredients that come from milk (either whole or skim milk powder, or concentrated evaporated milk), fruits, fruit juices or extracts, jams, cereals or any other flavoring, sweeteners, a quantity not exceeding 2.0% of texturizing agents (stabilizers, gelling, thickening or emulsifying agents), citric acid, food coloring and, in the case of yogurt with added fruit, fruit juices or extracts or jams, a preservative not exceeding 50 ppm. By definition, a "fat-free" food must contain less than 0.5 g of fat per portion. (http://www.milkingredients.ca/index-eng.php?id=197.9/3/2018, 11:00). The composition of regular, low-fat, and non-fat yogurt showed that in table 1.

Table 1. The composition of regular, low-fat, and non-fat yogurt

Parameter	Regular yogurt	Low-fat yogurt	Non-fat yogurt
Fat (%)	≥3.25	0.5 - 2.0	≤0.5
Solid Non Fat (%)	≥8.25	≥8.25	≥8.25
Titratable Acidity (%)	≥0.9	≥0.9	≥0.9
Ph	≤4.5	≤4.5	≤4.5

Sources: (Weerathilake et al, 2014).

D. Antimicrobial and antioxidant Activity

The Yogurt has contains LAB, that have function of health. Their growth depends on fermentation time, heat treatment and kind of sugar in milk (Hartati et al, 2012).Cow and goad yoghurt has antioxidant activity and which is increasing during fermentation (Rahmawati and Suntornsuk, 2016). Lactic acid bacteria can be producing antimicrobial compounds and it has contribution on human life (Khalid, 2011). Lactic

acid bacteria have ability to degrade Ochratoxin A during the digestion in gastrointestinal and virto. Which can be used in silage industry, winemaking and starter culture during alcoholic fermentation (Luz *et al* , 2018). Lactic acid bacteria have ability on help digesting food in the intestine and fermenting the foods variety and turn them into tasty food products with increased shelf life (Teusink and Molenaar, 2017). Lactic acid bacteria have capacity to release peptides with antioxidant activity through proteolysis (Rizzello et al, 2017). the grape marc fermented by lactic acid bacteria and bifidobacteria strains can be used as pharmaceutical or food supplement (Campanella *et al*. 2017).

E. Dehydration

Dehydration of food is the oldest operations used in food processing or food industry. Food dehydration is reducing moisture of food to low levels for increased shelf life. It is added a heat to the food by hot air, which also carries the moisture away from the food. Thus, it does not include removal of moisture from food by mechanical pressing or concentration of liquid foods (Jayas, 2016). Factors that affect stickiness have of great importance in the operation of spray dryers. Thus, stickiness of products during drying is effect on drying process, becauselly product deposits in the drying chamber, product quality, product recovery, cleaning frequency (Refstrup et al, 2015).

Dehydration is the use hot air or heated surfaces for removes water from foods and reduce their water activity. This inhibits microbial growth and enzyme activity to extend their shelf-life (Fellows, 2017) $_{a}$. The used heat for drying foods, or to concentrate liquids by boiling, removes water and therefore preserves the food by a reduction in water activity. However, the heat causes reduction in nutritional quality of product and effect on properties sensory. Also In freeze drying and freeze concentration is achieved preservation by reduction in water activity without heating the food with reduces the damage of heat (Fellows, 2017).

F. Freeze drying

The Freeze drying is used in many applications since old years, most commonly in the food and pharmaceutical manufacture. Freeze drying depend on the removal of water from frozen product by a process called sublimation. The sublimation occurs when a frozen liquid goes directly to the gaseous state without passing through the liquid phase. The freeze drying process has been three stages: pre-freezing, primary

drying, and secondary drying (Guide to Laboratory, 2010). The A typical phase diagram of freeze drying showed that in figure2.

G. Yoghurt drying

The prepared of dried yogurt samples were used method of (Carvalho et al, 2017). The formula for 100 grams of product is as follows: plain yogurts 42 g (Mercadona, Spain) were diverse with 25 g of mineral water. Separately, other 25g of water will be brought to a simmer and 4.4 g of is maltose, 2.2 g of malt dextrin (both from Cargill Iberica, Spain) and 0.2 g of sodium chloride was added until completely dissolved. 1.0 g of methylcellulose (Metolose MCE-400, Shin Etsu Chemical, Japan) and 0.2 g of xanthan gum (El Mazuelo, Spain) was then added and stirred. Immediately after, the mixture was added to the yogurt mix, mixed and put in a 1 L stainless steel foaming siphon, charged with one N_2O cartridge, shacked dynamically and directly put in a water/ice bath for 90 min. The siphon containing the blend was kept under cooling (4ºC) for 4 days. After this resting period, the mixture (10 g) was whipped onto cupcake silicon moulds. Half the produced whipped yogurt foams were frozen down to -80ºC for 24 hour, and was subsequently and immediately freeze-dried (FD) in a lab freeze-dryer (Lyoquest, Telstar, Spain) at 0.1 mbar for 22 hour. The rest of the foams were directly dried in a domestic dehydrator (Excalibur, Sacramento, USA), at 57ºC for 24 hour. After dehydration, keep the products into plastic sealed boxes with silica. The composition of the Commercial Yogurt Powder showed that in table 2, and number of lactic acid bacteria in yogurt powder (60^{o}C) and fresh yogurt showed that in table 3.

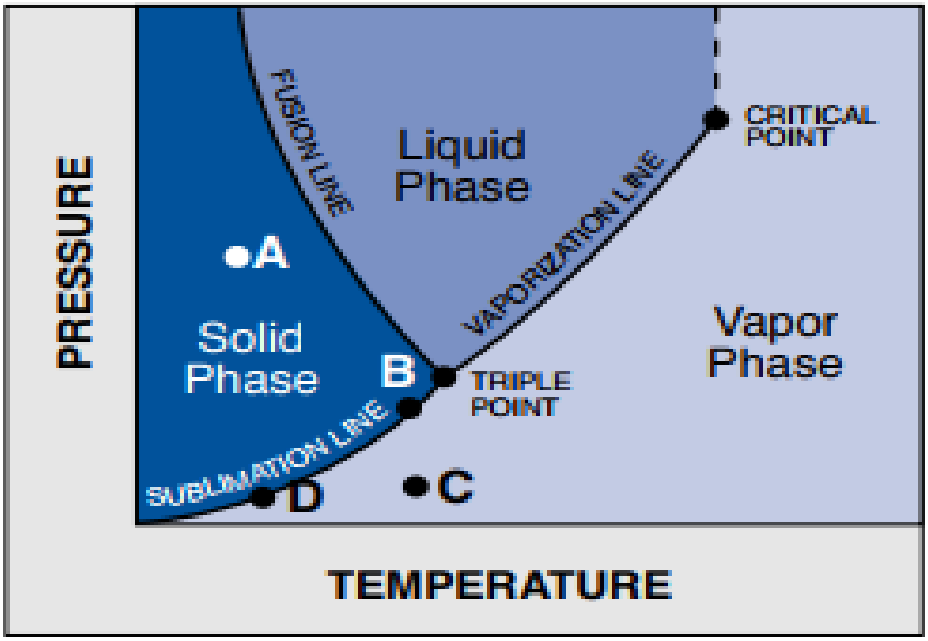

Figure 2: A typical phase diagram
Source: (Guide to Laboratory, 2010).

Table 2. Composition of the Commercial Yogurt Powder

Component	Percentage (%)
Fat	1.2 - 2.0
Moisture	3.0 - 5.0
Protein	33.0-36.0
Ash	7.0 - 8.0
Lactose	50.0- 51.5

Source: (Krasaekoopt and Bhatia, 2012).

Table 3. The number of lactic acid bacteria in yogurt powder ($60^{O}C$) and fresh yogurt

Yogurt type	Number of lactic acid bacteria (cfu g^{-1})
Fresh	9.8 x 107
Powder	5.6 x 107

Source: (Krasaekoopt and Bhatia, 2012).

H. Effect of dehydration on products

Power yoghurt produced by Spry-drying and Stored at 25 ^{o}C and 50% RH for 90 days their moisture and water activity values are increased. The titration acidity of samples is increased but PH value is decreased based on storage time. Also lactic acid bacteria count was decreased of storage (Balkir et al, 2011). Freeze-drying and air-drying can be used for dehydrating crispy dehydrated snacks. Freeze-drying lead to very aerated structure, softer final texture, and keeps original colour and flavour of raw materials. The air-drying lead to harder and crispier dried product, Millard reactions (Carvalho et al, 2017). The Thermal stability studies that both processes of freeze-drying and spray-drying not effect in behaviour of whey protein(Vincenzetti et al.

2018). The drying conditions and the storage quality for dried milk is the very importance. Freeze-drying is good method than spray-drying and drum-drying for lower loss lysine from powder milk during storage (Aalaei et al, 2016). For obtain longer shelf life and good quality of product, the yoghurt powder can be stored at low temperatures and dry condition (Chutrtong 2015). Freeze drying and freeze concentration has capacity of reduce water activity of foods a with keep nutritional and sensory qualities (Khalid, 2011).

CONCLUSION

The yoghurt powder produced by spray- drying at the optimum conditions. Which can prolong a shelf life of it's to 90 days by using packing material with lower moisture permeability and by selecting lower storage temperature and relative humidity.

Freeze-drying and air-drying can be used for dehydrating crispy dehydrated snacks. The freeze-drying lead to very aerated structure, softer final texture, and keeps original colour and flavour of raw materials. The air-drying lead to harder, crispier dried product and Mallard reactions. The freeze drying is suitable for yogurt dehydration because it lower effect on physico-chemical of product.

ACKNWOLEDGEMENT

The authors would like to thank of lecturers staff faculty of agriculture, Jenderal Soedirman University for their supports in completing the review.

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