CHAPTER I
INTRODUCTION

1.1 BACKGROUND

Colorectal cancer (CRC) is one of the most commonly diagnosed cancers in affluent countries and is a leading cause of cancer-related mortality in the USA and Australia. Change of consumption pattern and lifestyle, full with stress and bad lifestyles cause high prevalence of colorectal cancer case and increase interest of consumer in maintaining healthy gastrointestinal tract. Accumulating evidence from epidemiological and experimental studies suggest that diet is an important environmental factor in the aetiology of CRC.

Data derived from the Department of Pathology Anatomy, Faculty of Medicine, University of Indonesia, in the period of 1996 to 1999 revealed that there were 35.2% colorectal cancer cases of young age (less than 40 years). While the data of Ministry of Health revealed the incidence of colorectal cancer under 45 years of age in 4 major cities in Indonesia, i.e. 47.85%, 54.5%, 44.3% and 48.2% in Jakarta, Bandung, Makassar, and Padang respectively (Cravo, 1999). Compared to developed countries, there is higher incidence of young colorectal cancer patients in Indonesia (Sudoyo et al, 2010)

Sweet potato (Ipomoea batatas L) is a tuber crops relatively easy to be cultivated in Indonesia. Sweet potato also can be a cheap source of carbohydrate for Indonesian people. Variety of sweet potato has been developed to increase variation of Indonesia agriculture plant. High productivity of sweet potato, supported with appropriate climate and high preference of sweet potato by Indonesian people make it potential to be developed. Innovation of resistant starch based of sweet potato as a component of functional food can be an alternative to increase added value of the sweet potato starch.

Sukuh is one of the superior variety which is released by Research Institute for Legume and Tuber crops, Malang. Sukuh has ellipse and spherical tuber, short stalk tuber, yellow skin color, and white flesh color. Sukuh has highest starch content with 31% from 35% dry matter. Beside that, Sukuh has high productivity around 25-30 ton/ha and 2.0-2.5 months of harvest time (RILET, 2008). However, Sukuh is known as variety which is not sell well in market among other sweet potato that has colorful flesh. High productivity and high starch content make it potential to be developed as ingredient for functional food, like resistant starch.

Topping and Clifton (2001) reported that RS intake correlates negatively with colorectal cancer risk. The extensive studies have shown that resistant starch has physiological functions similar to those of dietary fiber (Asp, 1994). In addition, resistant starch also has functional effect as a prebiotic to promote the survival of intestinal microorganism.

Resistant starch defines as the sum of starch and products of starch degradation not absorbed in the small intestine of healthy individuals (EURESTA, 1993). Resistant starch is divided into 4 types, which are type I, II, III, and IV. RS1 is a physically inaccessible starch (e.g. coarsely ground grains and cereals); RS2 represents starch that is in a certain granular form including un-gelatinized starch granules (e.g. green banana, raw potato); RS3 is a re-crystallized or retrograded polymers of starch (e.g. gelatinized and cooled high amylose starch), and RS4 is a chemically modified starch (Englyst et al, 1992).

Resistant starch type III represents retrograded starch, which form the crystalline structure formation of amylose by hydrogen bond in double helices. Resistant starch results from the highly
retrograded of amylose fraction, the quantity formed being directly proportional to the amylose content (Annison and Topping, 1994). The degree of resistant starch formation depends on water content of starch suspension, autoclaving temperature, enzymatic reaction, cooling and drying process, and other component (e.g. lipid, protein, glucose) (Eerlingen and Delcour, 1995).

Resistant starch that reaches the large bowel is fermented by colonic microflora as a carbon source for its growth. Butyrate-producing strains of the genus *Eubacterium* are found in rather high cell counts (Finegold et al, 1983). The products of fermentation include gases (CO₂, CH₄, H₂), short chain fatty acids (acetate, propionate, butyrate), lactate, ethanol (Macfarlane and Cummings, 1991).

Fermentation product of resistant starch depends on fermentation substrate, type of bacteria, and starch degradation enzyme. Short chain fatty acid as a major of fermentation product has been shown to be the preferred energy substrate of the colonoocytes (Roediger, 1980) and reduced risk of colon cancer (Hill, 1995). Brouns et al (2002) and Wang et al (1999) proved that fermentation of resistant starch in colon produced the highest of butyrate ratio than fermentation of another dietary fiber (e.g. pectin, oat, bran, non starch polysaccharide, wheat).

One of the SCFA, butyrate, is known play a key role in the energy metabolism of the colonic epithelial cells and thought to be important in the maintenance of colonic health in humans (Mortensen and Clausen, 1996). Butyrate is utilized as an important energy source by the colonoocyte (Roediger, 1982). Butyrate also has a range of effects particularly relevant to bowel cancer. Recent study has also focused on the effects of butyrate on induction of apoptosis (e.g. programmed cell death) of cancer cell (Le Leu, 2007).

Estimation of short chain fatty acid in colon is done by *in vitro* fermentation. *In vivo* fermentation to estimate short chain fatty acid as a fermentation product is difficult because the absorption of SCFA is so fast. Beside, *in vitro* fermentation shows the pattern of bacterial growth in using resistant starch as a fermentation substrate (Khan and Edwards, 2005). Characteristics of resistant starch (e.g. quality, quantity, structure, fraction, and composition) influence proportion and profile of SCFA as the fermentation product (Tovar et al, 1992).

### 1.2 OBJECTIVE OF THE RESEARCH

The objectives of the research were to study short chain fatty acid profile during in vitro fermentation of *Eubacterium rectale* 17629 on Sukuh sweet potato type III resistant starch and to determine the effect of concentration of resistant starch to the SCFA profile by *Eubacterium rectale* 17629.

### 1.3 IMPLICATION OF THE RESEARCH

This research is expected to get basic information in developing functional food product derived from Sukuh sweet potato’s resistant starch in prebiotic form.