1. INTRODUCTION

Diabetes mellitus (DM) is recognized as a major health problem, as it is the fastest growing chronic condition globally. It is one of the metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action, or both (American Diabetes Association, 2009). The number of people with diabetes is growing worldwide and by 2040 it is estimated to rise to 642 million people (International Diabetes Federation, 2015). In Malaysia, 3.5 million (19.7 %) of the citizens, aged ≥ 30 years are diagnosed with diabetes, showing an increase in the number of patients (World Health Organization, 2016). In Denmark, 320,545 (5.7 %) of the citizens are diagnosed with diabetes (Danish Diabetes Association, 2017).

The upward trend of cases of diabetes has sparked awareness and worry in governments, that has prompted them to act to tackle this global health problem. The solution against this health problem requires researchers to do further studying on how to control, manage and treat this health problem.

Early management of the condition by controlling high blood glucose levels (hyperglycaemia) as well as by maintaining a healthy lifestyle and making better choices in diet can halt the development of Type 2 Diabetes (T2D). Balanced diet and increased physical activity may lead to improvement or normalization of blood glucose levels. A diet with non-starchy foods or food with low glycaemic index (GI) has been introduced for people to improve glycaemic control and insulin sensitivity (Brand-Miller; Hayne, Petocz, 2003; McGonigal & Kapustin, 2008). Reducing glucose uptake or inhibition of glucose liberation has also been explored as a means to reduce hyperglycaemia (Kabir et al., 2014; Kasner, Hunter, Ph, Kariko, & Ph, 2013). It is of high interest to study how consuming food from natural sources containing carbohydrate digestive inhibitors may affect glucose uptake and metabolism.

Marine-derived seaweeds may be one food candidate in terms of inhibitor content. The term “seaweed” refers to macroalgae and microalgae that belong to one of several groups of algae like red algae, green algae and brown algae (Baweja, Kumar, Sahoo, & Levine, 2016). Over the last decade, seaweeds have become ingredients in food and medicine (Fitton, Irhimeh, & Teas, 2007; Stengel & Walker, 2015). Seaweeds contain valuable nutrients and compounds such as fatty acids,

dietary fibres and polyphenols (Goñi, Valdivieso, & Garcia-Alonso, 2000; M. S. Kim, Kim, Choi, & Lee, 2008; B. Liu, Kongstad, Wiese, Jäger, & Staerk, 2016a; Lordan, Ross, & Stanton, 2011). Some of these bioactive compounds could be used for the management of hyperglycaemia. The identification of bioactive compounds from marine sources has seen increased interest among researchers of functional foods and in drug development. The application of seaweeds show an inhibiting effect on carbohydrate digestive enzyme activity *in vitro* (Gupta & Abu-Ghannam, 2011; Ikeda & Kusano, 1983; Liu, Kongstad, Wiese, Jäger, & Staerk, 2016; Lordan, Smyth, Soler-Vila, Stanton, & Ross, 2013).

Therefore, the investigations and exploitation of seaweeds in *in- vitro* and human studies have been suggested, as it may provide valuable evidence, which could potentially be used in to control blood glucose levels. This thesis focuses on the effects of seaweeds on carbohydrate digestive enzymes *in vitro* and possible effects on human postprandial blood responses.