UNIVERSITI PUTRA MALAYSIA

KNOWLEDGE, ATTITUDE AND PRACTICE IN RELATION TO EFFECTS OF PROBIOTICS IN FOOD AMONG MEDICAL FACULTY STUDENTS IN A MALAYSIAN PUBLIC UNIVERSITY

HAZIRAH BT AZMAN

FPSK(M) 2016 36

KNOWLEDGE, ATTITUDE AND PRACTICE IN RELATION TO EFFECTS OF PROBIOTICS IN FOOD AMONG MEDICAL FACULTY STUDENTS IN A MALAYSIAN PUBLIC UNIVERSITY

By

HAZIRAH BT AZMAN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

January 2016

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Degree of Master of Science

KNOWLEDGE, ATTITUDE AND PRACTICE IN RELATION TO EFFECTS OF PROBIOTICS IN FOOD AMONG MEDICAL FACULTY STUDENTS IN A MALAYSIAN PUBLIC UNIVERSITY

By

HAZIRAH BINTI AZMAN

January 2016

Chairman : Associate Professor Rukman Awang Hamat, Mpath

Faculty : Medicine and Health Sciences

Probiotic food products have been introduced in Malaysia since 1990's and have been claimed as a beneficial food to human health and human intestines. The objective of this study was to determine the significant difference in level of knowledge, attitude and practice on effects of probiotics in food among Faculty of Medicine and Health Sciences UPM students.

There were 222 respondents involved in this study which mainly from undergraduate and postgraduate students in medical and health sciences programmes. Self-administered questionnaires were given to the respondents and it contained Section A: Socio-demographics, Section B: Knowledge on probiotics, Section C: Attitudes on probiotics and Section D: Practices on probiotic consumption.

The results indicated that majority of the respondents had poor knowledge (50.5%), negative attitude (56.8%) and poor practice (70.3%) towards probiotics and probiotic food products. The chi-square results showed that there was significant difference in knowledge with practice (X^2= 4.59, p= 0.03) and attitude with practice (X^2= 6.28, p= 0.01). However, there was no significant difference in knowledge with attitude (X^2= 0.18, p= 0.67).

As a conclusion, majority of the respondents had poor knowledge, negative attitude and poor practice. It is recommended that the respondents should be exposed to health talk on probiotics or a probiotic training program conducted by the probiotic food manufacturers in enhancing their knowledge about probiotics.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk Ijazah Master Sains

PENGETAHUAN, SIKAP DAN AMALAN BERHUBUNG DENGAN KESAN PENGGUNAAN PROBIOTIK DALAM MAKANAN DI KALANGAN PELAJAR FAKULTI PERUBATAN DI SEBUAH UNIVERSITI AWAM MALAYSIA

Oleh

HAZIRAH BINTI AZMAN

Januari 2016

Pengerusi : Professor Madya Rukman Awang Hamat, Mpath

Fakulti : Perubatan dan Sains Kesihatan

Produk makanan probiotik telah diperkenalkan di Malaysia sejak tahun 1990 dan telah diperakui sebagai makanan yang dapat memberi manfaat kepada kesihatan manusia dan usus manusia. Objektif kajian ini adalah untuk menentukan perbezaan signifikan tahap pengetahuan, sikap dan amalan terhadap probiotik di kalangan pelajar di Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia.

Terdapat sebanyak 222 responden yang terlibat di dalam kajian ini di mana mereka terdiri daripada pelajar ijazah muda dan pasca-siswazah di dalam program perubatan dan sains kesihatan. Borang soal selidik telah diberi kepada responden dan ia mengandungi Bahagian A: Sosiodemografik, Bahagian B: Pengetahuan terhadap probiotik, Bahagian C: Sikap terhadap probiotik dan Bahagian D: Amalan terhadap penggunaan probiotik.

Keputusan menyatakan bahawa majoriti responden memiliki pengetahuan yang lemah (50.5%), sikap yang negatif (56.8%) dan amalan yang lemah (70.3%) terhadap probiotik dan produk makanan probiotik. Keputusan 'chi-square' menunjukkan bahawa terdapat perbezaan yang signifikan dalam pengetahuan dengan amalan (X^2= 4.59, p=0.03) dan sikap dengan amalan (X^2=6.28, p=0.01). Walaubagaimana pun, tiada perbezaan yang signifikan dalam pengetahuan dengan sikap (X^2=0.18, p=0.67).

Kesimpulannya, majoriti responden mempunyai pengetahuan yang lemah, sikap yang negatif dan amalan yang lemah. Ia disarankan bahawa responden didedahkan dengan ceramah kesihatan berkaitan probiotik atau program latihan probiotik yang dijalankan oleh pengusaha makanan probiotik untuk meningkatkan pengetahuan terhadap probiotik.

ACKNOWLEDGEMENTS

I would like to thank Associate Prof. Dr. Rukman Awang Hamat, Dr. Paul Yap Ray Yee and Prof. Mohd Yazid Abdul Manap, for participating in this project. A special thanks to Dr. Suriani Ismail and Dr. Rosliza Mohd Manaf, statisticians from Community Health Department for the assistance in teaching and guiding in statistical analysis. Not to forget, an appreciation to my family and for those who gave me the support and the encouragement.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Rukman Awang Hamat, Mpath
Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Mohd Yazid Abdul Manap, PhD
Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Member)

Paul Yap Ray Yee
Medical Lecturer
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

BUJANG BIN KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

Declaration by graduate student

I hereby confirm that:

- this thesis is my original work;
- quotations, illustrations and citations have been duly referenced;
- this thesis has not been submitted previously or concurrently for any other degree at any other institutions;
- intellectual property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
- written permission must be obtained from supervisor and the office of Deputy Vice-Chancellor (Research and Innovation) before thesis is published (in the form of written,printed or in electronic form) including books, journals, modules, proceedings, popular writings,seminar papers, manuscripts, posters, reports, lecture notes, learning modules or any other materials as stated in the Universiti Putra Malaysia (Research) Rules 2012;
- there is no plagiarism or data falsification/fabrication in the thesis, and scholarly integrity is upheld as according to the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) and the Universiti Putra Malaysia (Research) Rules 2012. The thesis has undergone plagiarism detection software.

Signature: _____ Date: _____

Name and Matric No.: Hazirah Binti Azman, Gs25251

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

Signature: _____

Name of Chairman of Supervisory Committee: Associate Professor Rukman Awang Hamat, Mpath

Signature: _____

Name of Member of Supervisory Committee: Professor Mohd Yazid Abdul Manap

Signature: _____

Name of Member of Supervisory Committee: Dr. Paul Yap Ray Yee

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

CI	Confidence interval
FAO	Food and Agriculture Organisation
FDA	Food and Drug Administration
F&N	Fraser & Neave
FOSHU	Food for Specified Health Uses
H_2O_2	Hydrogen peroxide
IBD	Inflammatory bowel disease
IBS	Irritable bowel syndrome
KAP	Knowledge, Attitudes and Practices
LAB	Lactic acid bacteria
MDD	Mamee Double Decker
Q	Question
USD	United State Dollar
WHO	World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Functional food

Food is important in maintaining human metabolic requirement. Human nowadays are more health-conscious towards foods. Improving the food contents seems to be very useful thus, scientists had come out with several ideas.

One of the ideas was creating foods that have special functional properties to human thus improvising the human health and even in preventing diseases. This kind of food is called as functional foods. In general, functional foods can be defined as healthy foods with health-promoting and/or disease preventing properties beyond the traditional and basic nutrients such as vitamins and minerals (Venter et al., 2010).

The markets for functional foods were high in the United States, Europe and Japan. In 2003, the sales for functional foods were about 33.6%, 28.2% and 20.9%, respectively (Granato et al., 2010). It was assumed that Malaysia has an attractive functional food and beverage niche but the market information on functional food products in Malaysia is still lacking compared to other developing countries (Lau et al., 2013).

There were several types of functional foods for examples bread (fibre-rich with fatty acids/omega 3/wholemeal), fruit juices (probiotic/added vitamins or minerals), biscuits (added with oat/low cholesterol/low fat/less sugar), cereal (oatmeal with beta-glucan/added vitamins and minerals/low fat) and many more. One of the major components of functional food is probiotic. Probiotic foods are foods that contain probiotic bacteria and provide health benefits to human (Molin, 2001). According to FAO/WHO (Food and Agriculture Organisation/World Health Organisation) definition, probiotics are live microorganisms which when administered in adequate amounts would provide a health benefit to host (Homayouni et al., 2012). The concept of adding probiotics into foods is not to remove harmful components but rather to add a beneficial component to the diet. Examples of variety types of probiotic foods are yoghurt, kombucha tea (fermented tea), miso soup, soy milk, kefir, sauerkraut, milk, dark chocolate, microalgae, pickles, tempeh, kimchi and olives in brine (Granato et al., 2010; Siró et al., 2008).

1.2 Statement of problem

The benefits of probiotics have been reported in various studies includes balancing the intestinal flora by increasing the lactose intolerance and

ingestion, reducing cholesterol levels, synthesis of B complex vitamins and cancer prevention (Viana et al., 2008). Probiotic can be found naturally in dairy and non-dairy food products. Nowadays, different types of probiotic bacteria are added to a wide variety of foods as a functional food including cheese, ice cream, milk-based desserts and fermented foods of plant origin, fruit juices, vegetables, legumes and cereals, malt and soybeans (Payahoo et al., 2012).

The availability of farmers or manufacturers to provide variety of probiotic foods for the consumers in Malaysia is still lacking. There were certain issues occurred when manufacturing the probiotic food products where the production was quite expensive and has multistage processes for example sensory acceptance, physical and microbial stability, price and chemicals (Granato et al., 2010). Moreover, in convincing the consumers to buy the probiotic food products, the manufacturers need to practice the principles of food safety, sensory appeal, brand marketing and others.

Even though numerous evidences are available in scientific and nutritional journals of the benefits for probiotic, Malaysian consumers were still unaware with probiotics in food and the importance of probiotics in health. This was because the Malaysian has less exposure about the knowledge in probiotics (Teng et al., 2012). Hence, this poor awareness may be due to lack of knowledge in consumer and the health professional which is the primary source of healthcare provider.

The students can also be considered as one of the consumers that would probably take the probiotic foods and concomitantly will provide the health information about probiotic foods to public and patients in the future. Therefore, the medical and health sciences students should be completely equipped with good knowledge, positive attitudes and positive practices as they themselves should be able to consult and provide the best information to their patients and public.

This study was conducted to assess the knowledge level, attitude and practices on effects of probiotics in food among Faculty of Medicine and Health Sciences Universiti Putra Malaysia (UPM) students in 2014.

1.3 Objectives

1.3.1 General Objectives

To determine the significance difference of knowledge level, attitude and practice on probiotics in food among UPM students' socio-demographic factors.

1.3.2 Specific objectives

1) To determine the respondents' socio-demographic factors (gender, ethnicity, age and marital status, educational level, study programme, work status and working sector).

2) To determine the frequency distribution in socio-demographic characteristics with respondents' level of knowledge, attitudes and practices on probiotic food products.

3) To determine the association between knowledge level and attitudes.

4) To determine the association between attitudes and practices

5) To determine the association between knowledge level and practices

6) To determine the association between respondents' socio-demographics (gender, ethnicity, age and marital status, educational level, study programme, work status and working sector) with knowledge level, attitudes and practices towards probiotics.

1.4 Hypothesis

1) **Null hypothesis:** There is no significant difference between socio-demographic and their knowledge, attitudes and practices on probiotic foods.

Alternative hypothesis: There is significant difference between socio-demographic and their knowledge, attitudes and practices on probiotic foods.

2) **Null hypothesis:** There is no significant difference between students' knowledge level on probiotics and their practices on probiotic foods.

Alternative hypothesis: There is significant difference between students' knowledge level on probiotics and their practices on probiotic foods.

3) **Null hypothesis:** There is no significant difference between students' attitudes and their practices on probiotic foods.

Alternative hypothesis: There is significant difference between students' attitudes and their practices on probiotic foods.

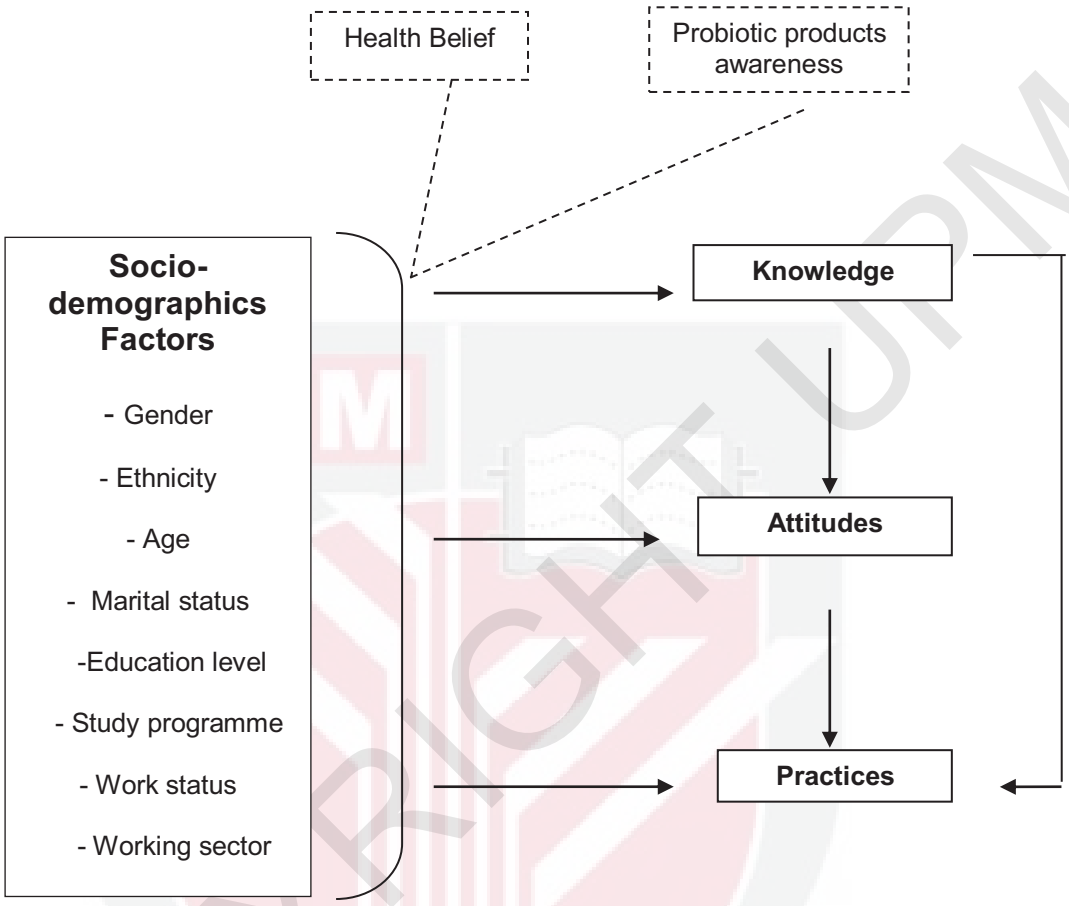

Figure 1. Conceptual Framework

Figure 1 represents the conceptual framework which explained the variables that were measured in this study. Socio-demographic factors were the independence variables while the KAP were the dependent variables. The measurements of KAP were made depending on the socio-demographic factors. Knowledge could affect the respondents' attitudes, meanwhile, attitudes could affect the respondents' practices and knowledge also could affect the practices. The dotted lines were confounders, which could also affect KAP but were not measured in this research because of the time constrain.

REFERENCES

Al-Muammar, M.N., Ahmad, S.M., Mahboub, S.M., Fetohy, A.A., Elareefy, A.A. and Feroze, S. (2013). Behaviour of consumers towards probiotic containing products and its related factors. *International Journal of Biology, Pharmacy and Allied Sciences.* 2(2): 208-219.

Anukam, K.C., Osazuwa, E.O. and Reid, G. (2006). Knowledge of probiotics by Nigerian clinicians. *International Journal of Probiotics and Prebiotics.* 1(1): 57-62.

Arora, M., Sharma, S. and Baldi, A. (2013). Comparative Insight of Regulatory Guidelines for probiotics in USA, India and Malaysia: A Critical Review. *International Journal of Biotechnology for Wellness Industries.* 2(2): 51-64.

Azoumadeh, N. 2012. *College Students' Perceptions of and Attitudes toward Probiotics and Probiotic Food Products*. Unpublished master dissertation, California State University, United States of America.

Azzura, A. and Paola, P. *Consumers' behaviours and attitudes toward healthy food products: The case of organic and functional foods*. Paper presented at the 113th EAAE Seminar, Greece. September 2009.

Azzura, A. and Vecchio, R. (2011). Factors affecting Italian consumer attitudes toward functional foods. *The Journal of AgroBiotechnology Management & Economics.* 14(1): 20-32.

Berhaupt, A. (2010). *The perceptions, attitudes and practices of registered dietitians regarding functional foods*. Unpublished master dissertation, Florida International University, United States of America.

Bilgiç, S. and Yüksel, A. In *University student's perception and attitudes towards functional foods in Istanbul*. Paper presented at the International Conference on Industrial Engineering and Operations Management Istanbul, Turkey. July 2012.

Biradar, S.S., Bahagvati, S.T. and Shegunshi, B. (2004). Probiotics and Antibiotics: A Brief Overview. *The Internet Journal of Nutrition and Wellness.* 2(1): 1-6.

Bridgman, S.L., Azad, M.B., Field, C.J., Letourneau, N., Johnston, D.W., Kaplan, B.J. and Kozyrskyj, A.L. (2014). Maternal perspective on the used of probiotics in infants: A cross-sectional survey. *BMC Complemetary and Alternative Medicine.* 14(366): 1-9.

Bruno, D. and Susana, M. 2006. Regulation of Toxin and Bacteriocin Synthesis in *Clostridium* species by A New Subgroup of RNA Polymerase σ-factors. *Research in Microbiology.* 157(3): 201-205.

Carvalho, N.B., Teixiera da Costa, T.D.M., Ferreira, M.A.M., Simiqueli, A.A. and Minim, V.P.R. (2014). Consumer attitude regarding products containing probiotics. *Ciência Rural*. 44(7): 1319-1326.

Chambers, S.A., Lobb, A.E. and Mortimer, D.T. *Attitudes and Behaviour towards functional foods: Focus Group*. Research councils, United Kingdom, 2006.

Chin-Lee, B., Curry, W.J., Fetterman, J., Graybill, M.A. and Karpa, K. (2014). Patient experience and use of probiotics in community-based health care settings. *Patient Preference and Adherence.* 2014(8): 1513-1520.

Chukwu, E.E. Nwaokorie, F.O., Yisau, J.I. and Coker, A.O. (2015). Assessment of the knowledge and perception of probiotics among medical science students and practitioners in Lagos State. *British Journal of Medicine & Medical research.* 5(10): 1239-1246.

Denéve, C., Janoir, C., Poilane, I., Fantinato, C. and Collignon, A. 2009. New trends in *Clostridium difficile* virulence and pathogenesis. *International Journal of Antimicrobial Agents.* 33(1): 24-28.

Ensminger, A. (2011). *Clinical use of probiotics: A survey of physicians' belief and practice patterns.* Unpublished master dissertation, Eastern Michigan University, United States of America.

Gerding, D.N., Muto, C.A. and Owens, C.J. (2008). Treatment of *Clostridium difficile* Infection. *Clinical Infectious Diseases.* 15(46): 32-42.

Granato, D., Branco, G.F., Nazzaro, F., Cruz, A.G. and Faria, J.A.F. (2010). Functional foods and nondairy probiotic food development: Trends, Concepts, and products. *Comprehensive Reviews In Food Science and Food Safety.* 9(3): 292-302.

Hanna, P. 2009. *Clostridium difficile* is no longer just a nosocomial infection or an infection of adults. *International Journal of Antimicrobial Agents.* 33(1): 42-45.

Hayatul S.S. and Nor Azila M.N. *Consumer-Behavioural Intention Towards The Consumption of Functional Food In Malaysia: Their Profiles And Behaviours*. Paper presented at The Clute Institute International Academic Conference Orlando, Florida. 2014.

Homayouni, A., Alizadeh, M., Alikhah, H. and Zijah, V. (2012). Functional dairy probiotic food development: Trends, Concepts and Products. In *Probiotics* (pp. 197-212). Creative Commons Attribution License.

Hedin, C.R.H., Mullard, M., Sharratt, E., Jansen, C., Sanderson, J.D., Shirlaw, P., Howe, L.C., Djemal, S., Stagg, S., Lindsay, J.O. and Whelan, K. (2010). Probiotic and Prebiotic Use in Patients with Inflammatory Bowel Disease: A Case-Control Study. *Inflammatory Bowel Disease.* 16(12): 2099-2108.

James, P.B. and Bah, A.J. (2014). Awareness use attitude and perceived need for complementary and alternative medicine (CAM) education among undergraduate pharmacy students in Sierra Leone: a descriptive cross-sectional survey. *BMC Complemetary and Alternative Medicine.* 14(438):1-9.

Jeżewska-Zychowicz, M. (2009). Impact of beliefs and attitudes on young consumers' willingness to use functional food. *Poland Journal Food Nutritional Science.* 59(2): 183-187.

Kaliyaperumal, K. (2004). Guideline for conducting a knowledge, attitude and practice (KAP) study. *Community Ophtalmology*. 4(1):7-9.

Lau, T.C., Chan, M.W., Tan, H.P. and Kwek, C.L. (2013). Functional food: A growing trend among the health conscious. *Asian Social Science.* 9(1): 198-208.

Launiala, A. (2009). How much can a KAP survey tell us about people's knowledge, attitudes and practices? Some observations from medical anthropology research on malaria in pregnancy in Malawi, http:// http://www.anthropologymatters.com/index.php/anth_matters/article/view/31/53.

Libby, D.B. and Bearman, G. 2009. Bacteremia due to *Clostridium difficile*-review of the literature. *International Journal of Infectious Diseases.* 13(5): 305-309.

Lyndhurst, B. *An Evidence Review of Public Attitudes to Emerging Food Technologies*.Social Science Research Unit. Food Standards Agency: United Kingdom, 2009.

Madden, J.A.J., Plummer, S.F., Tang, J., Garaiova, I., Plummer, N.T., Herbison, M., Hunter, J.O., Shimada, T., Cheng, L. and Shirakawa, T. (2005). Effect of Probiotics on Preventing Disruption of the Intestinal Microflora Following Antibiotic Therapy: A Double-blind, Placebo-controlled Pilot Study. *International Immunopharmacology.* 5(6):1091-1097.

Mercenier, A., Pavan, S. and Pot, B. (2003). Probiotics as Biotherapeutic Agents: Present Knowledge and Future Prospects. *Current Pharmaceutical Design.* 9(2): 175-191.

Miller, M. (2009). The Fascination with Probiotics for *Clostridium difficile* Infection: Lack of Evidence for Prophylactic or Therapeutic Efficacy. *Anaerobe.* 15(6): 281-284.

Molin, G. (2001) Probiotics in foods not containing milk or milk constituents, with special reference to Lactobacillus plantarum 299v. *The American Journal of Clinical Nutrition.* 73(2): 380-385.

Munene, J.C. and Dul, R.D. (2006). Exploring normative commitment with Nigerian extension workers. Public Administration and Development. 9(2): 169-183.

Ojetti, V., Gigante, G., Ainora, M.E., Fiore, F., Barbaro, F. and Gasbarrini, A. (2009). Microflora Imbalance and Gastrintestinal Disease. *Digestive and Liver Disease Supplements.* 3(2): 35-39.

Oughton, M.T. and Miller, M.A. 2008. Clinical and Epidemiology Aspects of *Clostridium difficile*. *Clinical Microbiology Newsletter* 30(12): 87-95.

Payahoo, L., Nikniaz, Z., Mahdavi, R. and Abadi, M.A.J. (2012). Perceptions of medical sciences students towards probiotics. *Health Promotion Perspectives.* 2(1): 96-102.

Prajapati, P., Patel, M. and Krishnamurthy, R. (2013). *Saccharomyces boulardii* – A probiotic of choice. *CIBTech Journal of Biotechnology* 2(2): 1-6.

Rezai, G., Zainalabidin, M. and Mad Nasir, S. (2012) Functional food knowledge and perceptions among young consumers in Malaysia. International *Journal of Agricultural, Biosystems Science and Engineering.* 6(3): 1-6.

Rosmawati, M., Ng, C.J., Tong, W.T., Suraya, Z.A., Wong, L.P. and Low, W.Y. (2012). Knowledge, attitudes and practices among people with chronic hepatitis B attending a hepatology clinic in Malaysia: A cross-sectional study. *BMC Public Health.* 12(601): 1-14.

Sarkar, S. (2013). Microbiological considerations for probiotic supplemented foods. *International Journal of Microbiology and Advanced Immunology.* 1(1): 1-7.

Sartor, R.B. (2008). Microbial Influences in Inflammatory Bowel Diseases. *Gastroenterology.* 134(2): 557-594.

Sääksjärvi, M., Holmlund, M.and Tanskanen, N. (2009). Consumer knowledge of functional foods. *The international Review of Retail, Distribution and Consumer Research* (pp. 135-156). Taylor & Francis Publishers.

Siti Asma, H., Norlela, O., Fauziah, M.I., Zaidah, A.R., Nurahan, M., Rosliza, A.R. and Tiong, C.G. 2012. Prevalence of *Clostridium difficile* toxin in diarrhoeal stool samples of patients from a tertiary hospital in North Eastern Peninsular Malaysia. *Medical Journal of Malaysia.* 67(4): 402-405.

Somehagen, J., Holmes, C. and Saleh, R. (2013). *Functional food - A study on consumer attitudes towards functional foods in Sweden*. Unpublished bachelor dissertation, Linnaeus University, Sweden.

Stanczak, M. and Heuberger, R. (2009). Assessment of the knowledge and beliefs regarding probiotic use. *American Journal of Health Education.* 40(4): 207-211.

Teng, P.K., Rezai, G., Zainalabidin, M. and Mad Nasir, S. In *Malaysian Consumers' Willingness-to-Pay for Functional Food*. Proceedings of the International Conference On Management, Langkawi, Kedah. June 2012.

Toma, M.M. and Pokrotnieks, J. (2006). Probiotics as functional food: Microbiological and medical aspects. *Acta Universitatis Latviensis.* 710: 117-129.

Urala, N. and Lähteenmäki, L. (2007) Consumers changing attitudes towards functional foods. *Food Quality and Preference.* 18: 1-12.

Venter, I. and Hanekom, M. (2010). Awareness and knowledge of Pro-, Pre-biotics and AB cultures among yoghurt buyers in four Pretoria suburbs and the factors determining their yoghurt buying decision. *Journal of Family Ecology and Consumer Sciences.* 38: 53-62.

Viana, J.V., Cruz, A.G., Zoellner, S.S., Silva, R. and Batista, A.L.D. (2008). Probiotic foods: Consumer perception and attitudes. *International Journal of Food Science and Technology.* 43(9): 1577-1580.

Walbrown, M.A., Aspinall, S.L., Bayliss, N.K., Stone, R.A., Cunningham, F., Squier, C.L. and Good, C.B. 2008. Evaluation of *Clostridium difficile*-Associated Diarrhea With a Drug Formulary Change in Preferred Fluoroquinolones. *Journal of Managed Care Pharmacy.* 14(1): 34-40.

Williams, M.D., Ha, C.Y. and Ciorba, M.A. (2010). Probiotics as therapy in gastroenterology: A study of physicians opinions and recommendations. *Journal of Clinical Gastroenterology.* 44(9): 631-636.

Wohlgemuth, S., Loh, G. and Blaut, M. (2010). Recent Developments and Perspective In The Investigation of Probiotic Effects. *International Journal of Medical Medicine* 300(1): 3-1.