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Development of novel "energy" snack bar by utilizing local Malaysian ingredients

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Abstract

The objective of this research is to develop an "energy" snack bar supplying energy and electrolytes in one bar by utilizing local Malaysian ingredients. The local ingredients used to make this snack bar were banana, glutinous rice flour, and coconut milk. It is a wholesome nutritious food for different age groups from adolescents to elderly people. Proximate composition, total carbohydrate, energy value, and sensory quality of prototype were determined. The developed snack bar contains 13.23% of moisture, 1.13% of ash, 6.36% of crude protein, 22.39% of crude fat, 1.16% of crude fibre, 56.89% of total carbohydrate, and 454.51 kcal of energy. The "energy" snack bar was highly acceptable with desirable sensory quality by all consumers.

Introduction

Snack bar, a convenient and healthy ready-to-eat food which supplies balance nutrients (protein, fat, minerals, vitamins, calories, and carbohydrate) and to abate hunger (King, 2006; Ryland *et al*., 2010; Wyatt, 2011) is continue to increase in sales. Snack bars initially marketed to athletes as a source of energy. However, the growing luxury groups and health-conscious consumers had increased the sales performance of snack bars (Wyatt, 2011; Euromonitor International, 2015). Data available on Statista (2015) reports recorded that retail sales of nutrition and energy bars in the United States are increasing year to year (from 2005 to 2014) from 0.57 billion U.S. dollars in year 2005 to 1.2 billion U.S. dollars in year 2014. In addition, according to Williams *et al*. (2006), 90% Australians regularly consume confectionary product (including food bars). Due to the growing consumer demand for natural, convenient, and nutritious food products, there is a need to modify, innovate and improve the nutritive composition of snack bars for health benefits (Williams *et al*., 2006; Sun-Waterhouse *et al*., 2010).

Besides requirement for energy and nutrients, human body also needs electrolytes for fluid homeostasis and balance. Healthy human body loses electrolytes through sweats, urine and defecation. Maughan (1991a) reported that during exercise the body may lose between 1 and 2 L of fluid per hour which equivalent to 40-80 mEq/L sodium loss and 80-160 mEq/L total electrolytes loss (Maughan, 1991b). Thus, athletes or physically active individuals should take sufficient amounts of carbohydrate before exercise, 'top-up' body's limited supply during workouts, and consume adequate amounts immediately after activity so as to replenish endogenous stores (Ali *et al*., 2011). However, athletes consume pure water immediately after their exercise may not be adequate to prevent progressive hypohydration. This is because the amount of fluid consumed by athletes does not match the electrolytes (sodium) losses through sweat (Greenleaf, 1992). Thus, intake of fluid containing electrolytes, particularly sodium is required to replace electrolytes and avoid the 'involuntary dehydration'. Therefore, sports drink is normally consumed by athletes to supply carbohydrate and electrolytes to compensate fluid and nutrient loss before, during and post exercise (Murray and Stofan, 2001). However, regular intakes of sports drink as a rehydration solution may harmful to health as sports drink contain high amounts of phosphoric acid and sugar. Phosphoric acid can deplete the calcium from bones and decrease its absorption further cause osteoporosis. In addition, high acid levels of sports drink or energy drinks also cause enamel dissolution leading to dental erosion and caries (Coombes, 2005). Sugar can elevate the blood glucose levels that contribute to the onset of type-2 diabetes and obesity in both children and adults (Anonymous, 2011).

Bananas are one of the most highly consumed

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fruits in the world, with a global annual production of 107 million tonnes in 2013 (FAOSTAT, 2015). Banana pulp has abundant of carbohydrates, nutrients (dietary fibre, minerals such as potassium, magnesium, and phosphorus), and antioxidants (Kanazawa and Sakakibara, 2000; Nieman *et al.*, 2012). However, banana fruit has very short shelf life, causing product losses and deterioration. According to Ng *et al.* (2014), the qualities (texture, flavour, and colour) of the fresh banana decrease rapidly after harvesting and these damaged bananas do not have any market value. In order to reduce the losses and prolong its shelf life, ripe banana are processed into various products such as banana powder or flour, banana chips, banana puree, banana juice, banana wine, banana jam, and jelly (Tsen and King, 2002; Sothornvit, 2011; Ng *et al*., 2014; Sagu *et al*., 2014; Coelho *et al*., 2015). According to Nieman *et al.* (2012), bananas are a cost effective energy source and used by recreational and endurance athletes because of the perception that the bananas can provide good carbohydrate and potassium support during prolonged and intensive exercise.

A study performed by Nieman *et al*. (2012) showed that trained cyclists consuming bananas or carbohydrate sports drink at a rate of 0.2 g/kg carbohydrate (every 15 min) with one 0.4 g/kg carbohydrate dose pre-exercise resulted in similar performance (completed 75-km cycling trials). In addition, the authors reported that the bananas provide the athletes with greater nutritional boost (potassium, fibre, and vitamin B6) and antioxidants which is not found in sports drink as well as it contains healthier sugars composition than sports drinks. Snack bar would be an ideal food format to deliver both energy and electrolytes for consumer. The consumption of carbohydrate-electrolytes containing snack bar with intake a cup of pure water as a transportation medium for electrolytes is now expected to be more convenient and healthy way.

Dodol is a popular traditional food that has brown, soft and elastic texture with sweet and savory taste (Malawat and Hidayah, 2013). It is made from glutinous rice flour, coconut milk, sugar, and sometimes with or without the addition of permitted food additives (Chuah *et al*., 2007). Starch is the most abundant reserve carbohydrate in glutinous rice (71-75%) (Gao *et al*., 2014). In China, glutinous rice is used as a traditional Chinese medicine for enhancing human physical power (Guo *et al.*, 2015). The processing of dodol involves starch gelatinization. With the present of water and heat, the starch granules begin to swell and weaken the hydrogen bonds between the starch granules till reach to a certain temperature (57-65°C, depending on the type of starch) the bonds begin to break (Chuah *et al*., 2007). Gelatinized glutinous rice starch not only served as a thickener and bulking agent in "energy" snack bar making, but its' special sticky characteristic provides binding, elasticity, and chewing (toffee-like soft texture) properties that could replace the use of caramel sugar.

With the background discussed as above, the main objective to conduct this study was to develop a convenient "energy" snack bar containing electrolytes by utilizing glutinous rice flour as a main source of energy as well as to replace the caramel sugar which contributes to toffee-like soft-texture. Banana served as a source of providing both energy and electrolytes. Oral rehydration salt was added into a formulation in order to fortify electrolytes content. The proximate composition and acceptability of the end products were also conducted. This product is expected to benefit those requiring source of carbohydrate to replenish depletion of energy and electrolytes during prolonged exercise.

Materials and Methods

Banana puree preparation

Ripe banana (*Musa acuminata* AA, Berangan) was purchased from a local wet market in Besut, Terengganu. A 100 g of banana was pureed manually using masher and then added with 20% w/v citric acid (8 g), maltodextrin (0.5 g), and carrageenan (0.5 g). The mixture was then stirred manually under mild heat till homogenous.

Snack bar base preparation

Ingredients for making snack bar base include palm sugar (250 g), pure water (125 mL), glutinous rice flour (200 g), coconut milk (225 mL), reconstitute milk (225 ml), table sugar (100 g), and oral rehydration salt (5 g). All the ingredients used were procured from local market (Pasaraya Pantai Timur, Kuala Besut, Terengganu). Dry ingredients such as glutinous rice flour and oral rehydration salt were blended with wet ingredients (water, reconstitute milk, and coconut milk). The mixture was then heated with constant stirring for approximately 15 min. Other ingredients (table sugar and pre-dissolved palm sugar) were then added into the mixture. The paste was stirred continuously for approximately 1 h till it became thick and freely sticks on the wok. The snack bar base was allowed to cool prior to snack bar preparation.

Snack bar filling making

The cooled snack bar base was rolled and cut into strip (70 × 20 × 5 mm). The banana puree (11/2 tsp) was placed and spread evenly on the strip and layered with another strip.

Tempering chocolate

Milk chocolate block was purchased from Beryl's Chocolate and confectionery Sdn. Bhd. Selangor, Malaysia. Seed tempering method as described by Cargill (2011) was referred to temper chocolate prior used. Untempered milk chocolate chunks were melted at temperature 45°C. About 4 large chunks of tempered chocolate were added and stirred continuously so as to cool the chocolate to temperature 30°C and provide "seed" crystals as they melt. The tempered chocolate was kept warm (32°C) to avoid over-seeding and mixed occasionally to maintain a consistent temperature prior used.

Snack bar assembly

The tempered chocolate was poured evenly into the mould (approximately 5 mm thick). Bubble rice (0.5 g) was then placed onto chocolate. A layer of base ingredient strip was placed on the bubble rice. The pre-roasted peanuts (1 g) were then placed randomly on the strip and finally coated with tempered chocolate (approximately 5 mm thick). The end product (Figure 1) was then cool in the refrigerator at 10°C for 1 hr prior analyses.

Proximate analysis

The chemical composition (moisture, crude protein, crude fat, ash, and crude fibre) of the product were determined (AOAC, 1995). Oven drying method (AOAC method 977.11) was referred to examine moisture content, Kjeldahl's method (AOAC method 955.04) for crude protein determination, Soxhlet method (AOAC method 960.39) for crude fat determination, dry ashing method (AOAC method 923.03) was performed to determine ash content, and gravimetric method (AOAC method 991.43) was used to determine crude fibre. The chemicals used in this study were of analytical grade.

Carbohydrate determination

The carbohydrate was calculated by difference (BeMiller and Low, 1998); carbohydrate = 100 g – (moisture + crude protein + crude fat + ash) g. Result was expressed as gram per hundred grams of dry matter (g/100 g of dry matter).

Determination of calorie

The calorie value of the sample was calculated according to Nielsen (1998). The total crude protein, crude fat, and carbohydrate were multiplied by the factor value (for each gram of protein and carbohydrate, 4 kcal of energy is obtained and 1 g of crude fat provides 9 kcal of energy); energy = (crude protein × 4) + (carbohydrate × 4) + (crude fat × 9).

Sensory evaluation

Sensory evaluation was conducted by 130 untrained panelists consisting of male and female non-smoker, age from 7 to 65 years old. The sensory was performed in a local supermarket (Pasaraya Pantai Timur, Kuala Besut, Terengganu). Sensory evaluation was conducted using a face scale. The scales were described as a series of line drawings of facial expressions ordered in a sequence from a smile (very like) to a frown (very dislike) (Stone *et al.*, 2012). The facial expression is accompanies by a five categories descriptive phrases (very like, like, moderate, dislike, and very dislike). Sample was served to the panelists by placing on a clean plastic plate labelled with three digits numerical code. Panelists were asking to evaluate product in the characteristics of colour, aroma, flavour, chewiness, sweetness, saltiness, and overall acceptability.

Statistical analysis

Statistical analysis was conducted using Statistical Package for the Social Science (SPSS) 14.0 software (SPSS Inc., Chicago, IL, USA). All the results obtained in the present study are represented as mean values of three individual replicate ± standard deviation (n=3 ± s.d).

Results and Discussion

Proximate composition

The results of proximate composition and energy value of the developed "energy" snack bar are shown in Table 1. The moisture content of the "energy" snack bar was 13.23%. The moisture content obtained from the present study showed higher than the result reported in fruit-based functional snack bars (5.6-11.7%). The high moisture content of the "energy" snack bar was due to the present of dodol which is categorized as intermediate moisture food (semi-moist food) has a moisture content of 10-40% (Malawat and Hidayah, 2013). Chuah *et al.* (2007) reported that the prepared traditional dodol has 19.2% of moisture content. However, the result obtained from the present study showed lower than the result reported for fruit bars made from date paste (Parn *et al.*, 2015). The authors reported that fruit bars processed from date paste contain 15.73-26.25%

Table 1. Chemical composition of "energy" snack bar

Composition	Dry weight basis (%)[a]
Moisture	13.23 ± 0.47
Crude protein	6.36 ± 0.80
Ash	1.13 ± 0.11
Crude fat	22.39 ± 0.07
Crude fibre	1.16 ± 0.10
Carbohydrate[b]	56.89
Energy (kcal)[b]	454.51

[a]Values are shown as mean ± standard deviation
[b]Values obtained by calculation (g/100 g of dry matter)

of moisture.

The present study showed "energy" snack bar had higher crude protein (6.36%) than fruit-based functional snack bars and fruit bar made from date paste (1.07-2.74 and 2.22-4.06%, respectively) (Sun-Waterhouse *et al*., 2010; Parn *et al*., 2015). However, it shows lower crude protein than the "energy" bar reported by other researchers for traditional energy bar (13.5%) (Reader *et al*., 2002). Williams *et al.* (2006) reported that snack bars with a high ratio of protein/carbohydrate may improve post meal and diurnal glucose profiles in patients with type-2 diabetes and insulin resistance.

The value of ash (1.13%) was comparable to those reported for snack bars contain apple dietary fibre bar with apple polyphenol extract (1.03%) and inulin with apple polyphenol extract (1.33%) (Sun-Waterhouse *et al*., 2010). This indicates that the "energy" snack bar may be contains macro- and micro- minerals as bananas (banana puree) which was recorded by many researches that it has rich source of essential minerals especially potassium (Kanazawa and Sakakibara, 2000; Nieman *et al.*, 2012).

Table 1 shows the values of crude fat (22.39%), crude fibre (1.16%), total carbohydrate (56.89%), and energy (454.51 kcal) of the prepared snack bar was higher than the values that have been reported by Reader *et al.* (2002). The authors reported that the traditional energy bar contains 11.9% of crude fat, less than 1% of crude fibre, 49.5% of total carbohydrate, and 360 kcal of energy. The high crude fat content of the present innovated product was attributed to the ingredients (i.e. coconut milk, roasted peanuts, and milk chocolate) used during snack bar preparation. Chuah *et al.* (2007) revealed that traditional dodols has 6.4% of crude fat. In addition, according to Chow *et al.* (2007), the ingestion of snack bars high in fibres is associated with greater ratings of fullness for up to 3 h as compared to snack bars with low fibre content. Therefore, it is expected that the present developed snack bar has longer fullness than the traditional energy bar.

Table 2. Average of the parameters on sensory evaluation of "energy" snack bar

Attribute	Score[a]
Colour	4.28 ± 0.71
Aroma	4.31 ± 0.65
Flavour	4.49 ± 0.66
Chewiness	4.19 ± 0.79
Sweetness	4.27 ± 0.81
Saltiness	3.99 ± 0.88
Overall acceptance	4.50 ± 0.75

[a]Values are shown as mean ± standard deviation

Sensory evaluation

Sensory evaluation is a scientific discipline used to determine, analyze, and interpret the reactions of the consumers to the characteristics of foods and other materials perceived by the senses of sight, smell, touch, taste, and hearing (Stone *et al*., 2012). Sensory quality evaluation is important for marketing purposes; the results give in-depth insight on the preference and overall acceptance towards product (Kemp *et al.*, 2011; Parn *et al.*, 2015).

Table 2 shows the results of sensory quality evaluation. The "energy" snack bar was acceptable as the product received rating greater than 3 with respect to the colour, aroma, flavour, chewiness, sweetness, saltiness, and overall acceptance. Colour is a primary perceived characteristic that plays an important role on the acceptability or even rejection by consumers (Malawat and Hidayah, 2013). Based on the statistical results, panelists rated the developed "energy" snack bar as "like" with the score value of 4.28. This indicates that consumers preferred colour of the product that is in dark brown. It was predicted that the dark colour of the outer layer was due to the nature colour of the milk chocolate. For the inner layer, it shows bright brown colour (Figure 1) might be attributed to the caramelization occurred during heating and boiling process with the presence of sugar.

The "energy" snack bar received score 4.31 and 4.49 for the parameters of aroma and flavour, respectively. The desired aroma and flavour was derived through caramelization, a browning process caused by a reaction of reducing sugars (sucrose from palm sugar) with primary amine groups under heating condition (Malawat and Hidayah,

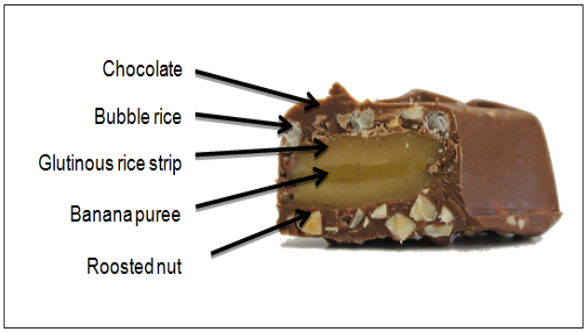

Figure 1. Cross-section of the assembled "energy" snack bar

2013). Therefore, the sensory attribute (colour) was positively correlated with aroma and flavour. Christensen (1983) reported that the coloured of the foods are perceived to have a stronger intensity and better quality aroma and flavour.

In terms of parameter in chewiness, the consumer rated the product as like (score 4.19). The product received a high score was attributed to the soft-textured of the dodol that gave major effects on the overall texture. In addition, the outer layer of the bar coated with milk chocolate can easily melted at body temperature. All of these properties contribute to the product easy to bite and masticate into a state ready for swallowing. Based on the results, it can be concluded that the developed snack bar is suitable for small children and elderly people.

Regarding sweetness and saltiness, consumers "like" the sweet taste of the presented product. They rated sweetness with score 4.27. However, consumers rated the product as moderate (neither like nor dislike) for salty taste with score 3.99. Some of the panelists commented that the presented product can be improved by increasing the level of saltiness.

Overall acceptance is an attribute determined by a combination of sensory perception components (colour, aroma, flavour, chewiness, sweetness, and saltiness) of a product. The mean score for the overall acceptance was 4.5 ("like"). The results suggested that the new innovated convenient "energy" snack bar has very high earnings potential in both domestic and foreign markets.

Conclusion

The "energy" snack bar prepared by utilizing local ingredients added with electrolytes provided easily, convenient, and healthier in comparison to current behavior on electrolytes replenishment through sports drink consumption. In addition, the snack bar produced from present study was comparable to the market available energy bar in proximate composition. The sensory evaluation results showed the "energy" snack bar prepared using the traditional food (dodol) with added electrolytes received a high acceptance by consumers and it has great potential to be commercialized. This product is recommended to those who require rapid energy recovery and replenishment of electrolytes at pre, during and post exercise. The "energy" snack bar can be consumed as a ready-to-eat healthy appetizer, especially for breaking the fast during the fasting month. Further studies are required to determine the shelf life of this product for better understanding on the food safety purpose.

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References

Ali, A., Duizer, L., Foster, K., Grigor, J. and Wei, W. 2011. Changes in sensory perception of sports drinks when consumed pre, during and post exercise. Physiology and Behavior 102: 437–443.

Anonymous. 2011. Hands on dental erosion sports drinks. Dental Abstracts 56(6): 299–300.

AOAC 1995. Official Methods of Analysis. Washington: Association of Analytical Chemists.

BeMiller, J. N. and Low, N. H. 1998. Carbohydrate analysis. In Nielsen, S. S. (Ed). Food Analysis, p. 169. Gaithersburg: An Aspen Publication.

Cargill. 2011. Tempering chocolate: hand tempering methods. Retrieved on July 10, 2015 from website: *http://www.wilburchocolate.com/wcm/groups/internal/documents/document/na3041991.pdf* .

Chow, J., Choe, Y. S., Noss, M. J., Robinson, K. J., Dugle, J. E., Acosta, S. H. and Garleb, K. A. 2007. Effect of viscous fiber-containing nutrition bar on satiety of patients with type 2 diabetes. Diabetes Research and Clinical Practice 76(3): 335–340.

Christensen, C. M. 1983. Effects of color on aroma, flavor and texture judgments of foods. Journal of Food Science 48(3): 787–790.

Chuah, T. G., Hairul Nisah, H., Thomas Choong, S. Y., Chin, N. L. and Nazimah Sheikh, A. H. 2007. Effects of temperature on viscosity of dodol (concoction). Journal of Food Engineering 80: 423–430.

Coelho, E., Vilanova, M., Genisheva, Z., Oliveira, J. M., Teixeira, J. A. and Domingues, L. 2015. Systematic approach for the development of fruit wines from industrially processed fruit concentrates, including optimization of fermentation parameters, chemical characterization and sensory evaluation. LWT–Food Science and Technology 62: 1043–1052.

Coombes, J. S. 2005. Sports drinks and dental. American Journal of Dentistry 18(2): 101–104.

Euromonitor International. 2015. Snack bars in Malaysia. Retrieved on July 10, 2015 from website: *http://www.euromonitor.com/snack-bars-in-malaysia/report*.

FAOSTAT (Food and Agriculture Organization of United Nations Statistics). 2015. Production crops: bananas. Retrieved on July 14, 2015 from FAOSTAT website: *http://faostat3.fao.org/download/Q/QC/E*.

Gao, X. Q., Zhang, W. G. and Zhou, G. G. 2014. Effects of glutinous rice flour on the physiochemical and sensory qualities of ground pork patties. Food Science and Technology 58: 135–141.

Greenleaf, J. E. 1992. Problem: thirst, drinking behavior, and involuntary dehydration. Medicine and Science in Sports and Exercise 26: 645–656.

Guo, L., Zhang, J., Hu, J., Li, X. and Du, X. 2015. Susceptibility of glutinous rice starch to digestive enzymes. Carbohydrate Polymers 128: 154–162.

Kanazawa, K. and Sakakibara, H. 2000. High content of dopamine, a strong antioxidant in Cavendish banana. Journal of Agricultural Food Chemistry 48: 844–848.

Kemp, S., Hollowood, T. and Hort, J. 2011. Sensory evaluation: a practical handbook. United Kingdom: John Wiley and Sons.

King, J. 2006. Nutrition bar update. Nutraceuticals World 9(1): 32–36.

Malawat, S. and Hidayah, I. 2013. The effects of the concentration of brown sugar and the comparison of cassava *(Dioscorea alata)* paste proportion to the making of "dodol" (Indonesian food). Journal of Agriculture and Veterinary Science 6(2): 9–15.

Maughan, R. J. 1991a. Effects of CHO-electrolyte solution on prolonged exercise. In Lam, D. R. and Williams, M. H. (Eds). Perspectives in Exercise Science and Sports Medicine. Ergogenics–Enhancement of Performance in Exercise and Sport, p. 35–85. United States: Cooper Publishing Group.

Maughan, R. J. 1991b. Optimizing hydration for competitive sport. In Lam, D. R. and Williams, M. H. (Eds). Optimizing Sports Performance. Perspectives in Exercise Science and Sports Medicine, p. 139–184. United States: Cooper Publishing Group.

Murray, R. and Stofan, J. 2001. Formulating carbohydrate-electrolyte drinks for optimal efficacy. In Maughan, R. J. and Murray, R. (Eds). Sports Drinks: Basic Science and Practical Aspects, p. 197–224. Boca Raton, FL: CRC Press.

Ng, K. F., Abbas, F. M. A., Tan, T. C. and Azhar, M. E. 2014. Physicochemical, pasting and gel textural properties of wheat-ripe Cavendish banana composite flours. International Food Research Journal 21(2): 655–662.

Nielsen, S. S. 1998. Nutrition labelling. In Nielsen, S.S. (Ed). Food Analysis, p. 44. Gaithersburg: An Aspen Publication.

Nieman, D. C., Gillitt. N. D., Henson, D. A., Sha, W., Shanely, R. A., Knab, A. M., Cialdella-Kam, L. and Jin, J. 2012. Bananas as an energy source during exercise: a metabolomics approach. PLoS One: 7(5): e37479.

Parn, O. J., Bhat, R., Yeoh, T. K. and Al-Hassan, A. A. 2015. Development of novel fruit bars by utilizing date paste. Food Bioscience 9: 20–27.

Reader, D. M., O'Connell, B. S., Johnson, M. L. and Franz, M. 2002. Glycemic and insulinemic response of subjects with type 2 diabetes after consumption of three energy bars. Journal of the American Dietetic Association 102(8): 1139–1142.

Ryland, D., Vaisey-Genser, M., Arntfield, S. D. and Malcolmson, L. J. 2010. Development of a nutritious acceptable snack bar using micronized flaked lentils. Food Research International 43: 642–649.

Sagu, S. T., Nso, E. J., Karmakar, S. and De, S. 2014. Optimisation of low temperature extraction of banana juice using commercial pectinase. Food Chemistry 151: 182–190.

Sothornvit, R. 2011. Edible coating and post-frying centrifuge step effect on quality of vacuum-fried banana chips. Journal of Food Engineering 107: 319–325.

Statista. 2015. Retail sales of nutrition and energy bars in the U.S. from 2005 to 2015 (in million U.S. dollars). Retrieved on July 11, 2015 from website: *http://www.statista.com/statistics/235816/us-retail-sales-of-energy-bars/*.

Stone, H. Bleibaum, R. and Thomas, H. A. 2012. Measurement. In Stone, H. Bleibaum, R. and Thomas, H. A. (Eds). Sensory Evaluation Practices, p. 101-104. United States: Academic Press.

Sun-Waterhouse, D., Teoh, A., Massarotto, C., Wibisono, R. and Wadhwa, S. 2010. Comparative analysis of fruit-based functional snack bars. Food Chemistry 119: 1369–1379.

Tsen, J. H. and King, V. A. E. 2002. Density of banana puree as a function of soluble solids concentration and temperature. Journal of Food Engineering 55: 305–308.

Williams, G., Noakes, M., Keogh, J., Foster, P. and Clifton, P. 2006. High protein high fibre snack bars reduce food intake and improve short term glucose and insulin profiles compared with high fat snack bars. Asia Pacific Journal of Clinical Nutrition 15(4): 443–450.

Wyatt, S. L. 2011. State of the snack industry 2010. SymphonyIRI Group. Retrieved on July 14, 2015 from website: *http://www.healthycornerstores.org/wp content/uploads/2011/11/SNAXPO-2011.pdf*