PERCEPTIONS ON THE EXTENT OF *Cocos nucifera* TODDY COLLECTORS' FOOD SAFETY PRACTICES: A BASIS FOR INTEGRATION OF FOOD SAFETY IN THE SCIENCE CURRICULUM

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ABSTRACT

This study intended to determine the extent of food safety practices as perceived by the Cocos nucifera toddy collectors where one hundred forty (140) coconut toddy collectors from the different areas of Guihulngan City serve as respondents. The study is descriptive and correlational in nature and based from the results of the respondents – toddy collectors' responses. The set of questionnaires is based on the Good Manufacturing Practices (GMP) of the Philippine National Standards. Frequency Distribution, Percentage, Weighted Mean, t-test, and Pearson Product-Moment Correlation Coefficient are the statistical tools.

The findings reveal that the respondents' average age is 53 years old, and of low literacy. The least experienced of whom have worked in 1-5 years, the rest 17-24 years. The average household size is about 5.5 and most depend on toddy collection for their livelihood. Two groups of respondents are examined as to their hygienic practices perceptions and their actual practices. As the number of work experience increases, the use of the more modern and hygienic metal screw cap was used as lid for toddy containers, the rest used guava (Psidium guajava) leaves.

Both groups do not essentially differ in their perception on safety practices except the one cited on container lids. Neither does their profile, except that the more experienced used the more hygienic metal screw cap, as cited earlier. In summary, according to the respondents' perceptions, their hygienic practice, in all facets of their toddy collection, is quite high. But if we take into account, their hygienic practices have still a lot to be improved.

Keywords: *Food Safety, Cocos nucifera, Toddy Collectors, Science Curriculum*

INTRODUCTION

Food safety is a public concern. Accessibility and availability of quality foods is a basic right of every Filipino. However, the obligation of keeping food safe is a shared responsibility in any society. Since food safety is sometimes adversely affected by people's hygiene and health practices, the Department of Health's vigilant role is important.

Considering that food production undergo several processing steps from farm to plate, the need to have a strong food control system must be established. In the Philippines, the Bureau of Food and Drugs (BFAD) under the leadership of DOH has been implementing the country's food control system in partnership with other government agencies (DOH 2008). However, adverse food safety incidents, such as the deliberate melamine contamination of milk and milk products from China, found in pet food products in 2006, sparked the interests of the public to examine the current status of food control system.

Food safety remains a critical issue with outbreaks of foodborne illnesses resulting in substantial cost to individuals, the food industry, and the economy. Changes in modern food production, the impact of modern lifestyles, changes in food consumption, and the emergence of new pathogens are rapidly taking their toll (Collins et.al. 1989; Tauxe 1997).

A number of food-related crises in recent years raised the awareness of agri-food companies and supply chains to improve product safety. Globally, the incidence of foodborne diseases is increasing and international food trade is disrupted by frequent

disputes over food safety and quality requirements.

Mishandling of food plays a significant role in the occurrence of foodborne illnesses. Improper food handling may be implicated in 97% of all foodborne illness associated with catering outlets (Howes et.al. 1996). Food handlers may also be asymptomatic carriers of food poisoning organisms (Cruickshank 1990). Food safety requires proper handling from production through consumption. Although standards and consumer guidance on proper food handling are available through magazines, newspapers, food labels, and other sources, mistakes still occur. In addition, microorganisms use our food supply as a source of nutrients for their own growth which can result in deterioration of the food quality (Frazier & Westhoff 1998).

This study examined how Cocos nucifera toddy collectors in Guihulngan City, Negros Oriental perceived their food safety practices. The findings of this study could be a basis for the integration of food safety management in the Elementary Science Curriculum.

According to the Philippine Coconut Authority (PCA), the coconut tree provides fruit throughout the year and the fruit is edible at any stage of maturity. The fruit also serves as the source of raw material in many food products such as coconut milk/cream, desiccated coconut, coconut chip, coconut water, nata de coco, coconut oil, and others. Out of the bud of the coconut trees' inflorescence is a juice, a refreshing beverage enjoyed by people in parts of Africa, Asia, and South America, which is referred to as "tuba" in the Philippines, "toddy" in Sri Lanka, and "tuak" in Indonesia (Lasekan et.al. 2007; Abbas et.al. 2010; Manel et al. 2011). This coconut toddy can be further processed into food products such as coconut sap syrup and coconut sap sugar (PCA 1).

Like in many places of Asia and some parts of Africa and South America, toddy collection and production of this local beverage is also active in Negros Oriental, where this study is conducted. The researcher believes that this study is important because the coconut toddy is highly prized nowadays, not only for the local drinkers but also in the processing of various food products.

The coconut toddy is used by some bakers in Negros Oriental and Cebu in making bread and pastry dough. It can be further processed into coconut sap syrup and coconut sap sugar where Foundation University in Dumaguete City is the pioneering institution in the coco sap sugar production.

In the study conducted by the Food and Nutrition Institute (FNRI) on the nutritional and health benefits of coconut sap syrup and sugar, it was found to be low in Glycemic Index (GI). The GI of foods is associated with the risk of common diseases such as type II diabetes and coronary heart disease. In 1999, the World Health Organization (WHO) and Food and Agriculture Organization (FAO) recommended low GI-foods to prevent diseases such as coronary heart disease, diabetes and obesity (University of Sydney).

On the other hand, the researcher's choice of the subject for this research project is related to her chosen profession as a Physical Science Instructor where she teaches students taking major and minor subjects in Science, to formulate ideas in Chemistry, Physics, Biology, Earth and Environmental Science, including the food safety concepts which could be of help in everyday living. Knowing that foods are our source of nutrients, energy, and growth, the researcher firmly considers the significance of the role of education in advocating and imparting the food safety concepts.

Understanding the concepts of hygienic practices paves the way to the right practices that will help minimize microbiological, physical, and chemical hazards associated with all stages of production in the processing of coconut toddy. Thus, criteria have been developed to give an assurance that food is safe and of suitable quality and will definitely meet its shelf life provided it is handled appropriately.

This study is anchored on the concept of *current Good Manufacturing Practices (cGMP)* by the Food and Drug Administration as the Philippine National Standard and Recommended Code of Practice for the processing and handling of tropical fruit wines (2). This development of the standard aims to set the high standard of the *"Tuba"* product, provides guide for the assurance of its quality and safety, and prepare the products to be more competitive in the world market. The current Good Manufacturing Practices or cGMP as recommended by the FDA is a "quality assurance system aimed at ensuring that products are consistently manufactured, packed or repacked, or held to a quality appropriate for the intended use" (4). It is thus concerned with both manufacturing and quality control procedures.

Moreover, this study is likewise anchored on the *Code of Hygienic Practices (COHP)* which addresses the essential principles of food safety applicable to primary production, postharvest, transport operations and processing. It encompasses Good Hygienic Practices (GHP) and Good Manufacturing Practices (GMP) that will help reduce the hazards mentioned which are associated with all stages of production to processing of coconut sap or toddy. It also provides the relevant general hygienic recommendations for the primary production of fresh agricultural commodities. The COHP is applied together with another code of practice, the *Codex Recommended International Code of Practice-General Principles of Food Hygiene (CAC/RCP 1-1969, Rev 4:2003)* which

provides specific guidance to minimize microbiological hazards from primary production through processing, packing and distributing of coconut saps.

The theoretical framework suggests that the viability of microorganisms leading to microbial contamination of tuba could be associated with the methods applied during production, harvest and processing. Moreover, contamination may also happen at retail outlets, food service establishments, and home kitchen via improper handling and storage prior consumption.

The Good Manufacturing Practices (GMP) includes the eight (8) General Principles of Food Hygiene: design and facilities, control of operations, maintenance and sanitation, personal hygiene, transportation, product information and consumer awareness, and training, covering the scope of the entire food chain.

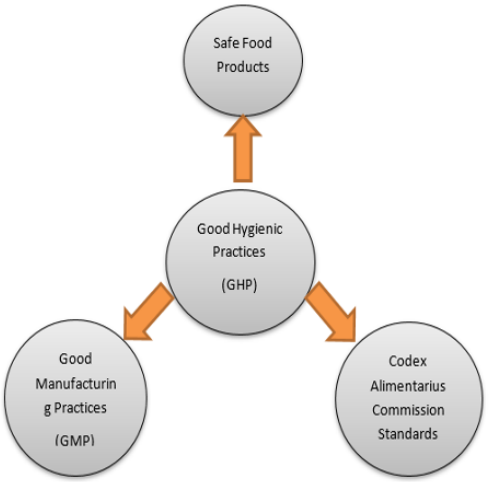

Figure 1. Schematic Diagram of the Theoretical Framework of the Study

Based on Good Manufacturing Practices (GMP) in 2014 by the PNS and Codex Alimentarius Commission (CAC) Standards in 2005 by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) which leads to Good Hygienic Practices (GHP) ensuring Food Safety.

The purpose of the study was to determine the extent of food safety practices as perceived by Cocos nucifera toddy collectors, in various stages of toddy collection in Guihulngan City, Negros Oriental.

Specifically, this study sought to answer the following questions:
1. What is the profile of the respondents in terms of the following:
   1.1. age;
   1.2. educational attainment;
   1.3. years of experience;
   1.4. size of family; and
   1.5. work and ownership status?
2. To what extent do toddy collectors apply the safety practices in the handling of coconut toddy in terms of:
   2.1. personal hygiene;
   2.2. use of facilities;
   2.3. equipment sanitation; and
   2.4. process control?
3. What is the extent of use of tuba gathering equipment by toddy collectors?
4. Is there a significant relationship between the toddy collectors' extent of application of safety practices in handling of coconut toddy and their profile?
5. Is there a significant relationship between the toddy collectors' extent of use of the tuba gathering equipment and their profile?
6. Is there a significant difference between toddy owner-collectors and collectors only in terms of hygienic practices?

RESEARCH DESIGN AND METHODS

This study made use of descriptive method of research and correlational method since the respondents' profile was correlated with their food safety practices and use of *tuba* gathering equipment. Calderon et al. defined descriptive research as a method that describes and interprets the data (23); and often involves some type of comparison or contrast more than and beyond data gathering (qtd. in Eva 2011). This method reveals problems or even abnormal conditions in which remedial measures may be instituted.

This study provides food handlers with basic checklists for internal inspections of their food processing facilities. Stratified random sampling was applied for the selection of toddy collectors as respondents who maybe owner-collectors or just plain collectors.

The study was conducted in the City of Guihulngan, Negros Oriental, 116 kilometers away from Dumaguete City but close to San Carlos City. Guihulngan public market is located at Poblacion, Guihulngan City. The City is the center of trade and industry and serves as the "bagsakan" of gathered Tuba from the coconut plantation vicinity.

In this study, the researcher included respondents coming from the different areas in Guihulngan City who are coconut toddy collectors. Some of the respondents are owners of coconut trees as well as toddy collectors. They are called "mananggiti" or "manananggot" of *tuba* in local dialects. There are 140 toddy collectors (49 of whom are owner-operators) who were interviewed and served as the respondents of the study.

This study made use of documentary analysis for the profile of the respondents. Questionnaires were developed for this study which were adapted from Good Manufacturing Procedures (GMP's)

Standards. The questionnaires were given to the respondents for them to fill out important data. In addition, interviews were conducted by the researcher in gathering relevant data needed for the study.

The questionnaire was structured and divided into three (3) parts. The first part relates to the respondents' demographic characteristics (age, educational attainment, number of years as toddy collector, family size, and status of work). The second part includes parameters that are divided into four (4) sections. The first section is "Personal Hygiene" with 6 questions; followed by "Use of Facilities" with 5 questions; 6 questions are included in the third section named "Equipment Sanitation"; and the fourth section is "Process Control" with 6 questions. All sections are designed to assess the extent of food safety practices as perceived by the coconut toddy collectors. And the last part of the questionnaire relates to the respondents' extent of use of tuba gathering equipment.

The response format requires the respondents to express their degree of agreement with each statement on a five-point Likert Scale consisting of responses: Almost Always (AA), Frequently (F), Sometimes (S), Rarely (R), and Almost Never (AN). In getting the average response of the toddy collectors, AA, F, S, R, and AN are scored 5, 4, 3, 2, and 1 respectively.

RESULTS AND DISCUSSION

From the data gathered in the study, the following salient findings are hereby presented:

Respondents' Profile

The study revealed that out of the 140 total number of respondents, 21 belong to the oldest age bracket of 61-75; 19, youngest age group of 16-30 while the rest of the respondents, 31-60 years old. Lowest literacy rate was reported by 73 respondents who have reached the elementary level only; 36 have graduated from elementary while the rest of the respondents reached high school and college level. From the data, majority of the respondents have low educational background. Many cited reasons like lack of financial capability. They also stated that their old folks have brainwashed them by saying "Walay nadato sa eskuyla!" (Nobody got rich by going to school!)

Of the 140 respondents, 24 respondents revealed that their highest work experience as toddy collectors is 21 years and above; whereas 48 respondents have the lowest experience of 1-5 years.

On the other hand, the largest family size of 9 and more was reported the lowest by 19 respondents; 32 with 3-4; while the largest number of respondents reported 5-6 as average size. 49 respondents declared themselves as owner-collectors of coconut trees that they maintained for tapping, and majority (91) are plain toddy collectors.

Extent of Food Safety Practices Applied by the Respondents

The extent of food safety practices applied by the respondents in terms of personal hygiene for both owner-collectors and collectors only is "High", while their use of facilities scored "Very High". This finding is comparable to the Standard 3.2.2 on Food Safety Practices and General Requirements of Australia and New Zealand. The FDA of 2009 standard states that those who can contaminate food are those who do not practice proper personal hygiene, including handwashing at the appropriate times. Other studies are also found to be in consonance with the finding that food safety training is positively associated with self-reported changes for the better food safety practices (McElroy and Cutter 2004).

The extent of use of equipment by both owner-collectors and collectors coincides most of the time scoring an average of "High", and process control is "Very High".

Extent of Use of the Equipment by the Respondents

The extent of use of the equipment by both owner and collector coincides most of the time; thus, having the average of "Moderate", although there are times that the respondents prefer equipment that are not hygienically acceptable.

Their practice differs on the use of plastic screw cap as lid since the extent of use of owners is "Very High" while that of the collectors is "High". However, nobody uses metal screw cap except for a very few. For the leaves as lid, the owners did not prefer its usage with a weighted mean of (= 1.37) thus, its extent is "Very Low". On the other hand, the non-owners got a weighted mean of (= 1.90) for higher frequency of usage of leaves as cover than the toddy owners. Based on the findings, the owner knows the hazards of using leaves which can contaminate their toddy. On the other hand, the collectors use this type of cover frequently without considering its hazard.

According to the PNS that only heat resistant glass bottles and caps shall be used. In this manner, the finding does not totally conform with the standard for cap usage since the latter (glass cap) is rarely available in their area.

Relationship Between the Respondents' Food Safety Practices and Their Profile

The data indicate that all the computed values of "r" are less than the tabular value of "r". At 5% level of significance and 138 degrees of freedom, this finding results to the non-rejection of the null hypothesis. This means that the data are not sufficient to conclude that the variables are related. It reveals that there is no significant relationship between the respondents' food safety practices in 4 areas and their profile. This also implies that the demographic factors like age, experience, education, household size, and work status were not in any way correlated with their food safety practices. Therefore none of these variables, both owner-collectors and plain collectors do not vary in their food safety practices. This also implies that old or young, with high or low educational attainment and experience, and household size have nothing to do with their hygienic practices.

Another study by Henderson et al. on 2012 (150-156), both trained and untrained groups of food handlers have improved knowledge on safety practices resulting from supervisory status and years of experience, though increasing age was important for the untrained group for improved knowledge. However, trained food handlers' knowledge on food safety were significantly high compared with the untrained handlers. This implies that training program is an important factor which affects the food safety practices of food handlers. This also jives with another study which states that training helps to improve overall employee knowledge of food safety (Costello et al.4; Finch and Daniel 12; Roberts et al. 9).

It is assumed then, that in this study supervision and training of toddy collectors are important on the actual proper food safety management of toddy collection.

Relationship Between the Respondents' Extent of Use of the Equipment and their Profile

Two variables reflected a significant relationship - their years of work experience and their extent of use of metal screw cap with covered center opening. This means that the higher is their years of experience, the more frequent is their usage of the said equipment (1-5 yrs: =1.40; 6-10 yrs: =1.53; 11-15 yrs: =1.70; 16-20 yrs: =1.73; 21 yrs and above : 2.13).

The data also indicate that a significant relationship exists between the status of work of the toddy collectors and their use of a type of lid. This means that plain toddy collectors have higher usage of this lid than the toddy owner-collectors. The non-owner toddy collectors relatively use guava leaves more often to cap their containers than the owner-collectors. The usage of the respondents of the metal screw cap as lid is "Very Low", but this result is significantly related with the respondents' work experience This means that as the years of experience increases, the extent of usage of the metal cap equipment relatively increases although the increase is not high enough to be classified as moderate, high, or very high extent of safety practice.

According to the Philippine National Standard (PNS) only heat resistant glass bottles and closures or coverings (lids) shall be used. Generally, the higher is the number of years of experience attained by the respondents, the higher their level of knowledge. This knowledge will guide them in knowing the properties of metals which is a good conductor of heat, malleable and ductile, solid and lustrous (Encarta Dictionary,2009). Although glass is more preferable hygienically, none is available in the area. Thus, they prefer the plastic screw cap as lid, the second best hygienically in their area.

According to Henderson et al. (2012) food handlers' status and years of experience have improved the knowledge on food safety practices. The experience they already have will guide them on the right track and train them to produce safe and clean product. Moreover, trained food handlers are better able to enumerate food safety principles. But the finding does not conform to the finding of Luby, Jones, and Horan (13) and Pilling et al. (8) that training based on their studies, is not consistently associated with improved knowledge.

The data also indicate that a significant relationship exists between the status of work of the toddy collectors and their extent of use of leaves as lid. This means that toddy collectors/non owner (= 1.90) have higher usage of leaves for lid than the toddy collector/coconut owner (= 1.37) who preferred plastic screw caps for lid. Since the respondents have low educational attainment, their knowledge is not enough on the physical hazards brought by the equipment. But they are applying the method that they think is correct since they have already practiced it for a longer period of time which they have followed from their descendants. According to Sevilla (2006) "attitude can influence behaviour and behaviour can be predicted from them". This attitude can have long and lasting impact to an individual, groups or society. Martin et al. also stated (13-14) that attitudes are dynamic results of experience and carry emotional and intellectual tone (qtd. in Mira 2013). The study of Egan et al. in 2007 corroborates with the findings of Sevilla and Martin, that attitude which is a cognitive element could influence the food safety behaviours and practices (1185).

Difference on the safety practices of the toddy owner-collectors and collectors only

The same extent of safety practices were

applied by the two groups of respondents with a composite of "High". Thus, with "High" extent of composites, the finding denotes that the extent of food safety practices applied by toddy collectors reaches the standard safety practices.

The finding results to the acceptance of the null hypothesis. This means that the perceptions of the two groups of respondents on their safety practices do not differ significantly.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the findings cited above, the following conclusions are hereby drawn:

Majority of the respondents were 46-60 years old at the time of the study. They reached the elementary level only. Most of them had few years (5-6 years) of experience in the field of tapping. Household size averaged 5.5. The respondents depended mostly on toddy collection as their source of income.

Personal hygiene of most toddy collectors is "High". Use of facilities and process controls scored "Very High". For the use of equipment, they scored from moderate to high.

Potable water used to wash the respondents' equipment scored "Very High". Some respondents used non-potable water, scoring "Moderate". The extent of use of the tuba gathering equipment by both types of respondents indicates a "Moderate" level which is verbally described as "Sometimes".

There is no significant relationship between the respondents' age, education attainment, work experience, family size, and work status. These variables have nothing to do with their safety practices. It means that this rating on safety practices were the same, whether they are old or young, experienced or not, with a small or large household, and with work status of either owner-collectors or collectors only.

A significant relationship existed between the number of work experience of the toddy collectors and their extent of use of metal screw cap with covered center opening. As their years of experience increase, the extent of usage of the metal cap equipment also increases. However, the increase is not high enough to be classified as moderate, high, or very high extent of safety practice.

The data also indicated that a significant relationship exists between the status of work of the toddy collectors and their extent of use of leaves as lid. This means that toddy collectors/ non owner used leaves as container lid more frequently than collector/coconut owner.

The perception of the two groups of respondents on their applied safety practices in the different steps and processes of toddy collection is just the same. This finding led to the acceptance of null hypothesis. There is no significant difference on the safety practices applied by both types of respondents.

Although the findings revealed that according to the perceptions of the respondents, their practices match those of the food safety standards, which may produce a relatively good product, there is still much room for improvement. Actual, tangible, investigatory research should be done to corroborate and prove their perceptions.

Recommendation

On the bases of the findings and conclusions drawn, the following measures are recommended:

A Food Safety Practice Modification should be made specifically on the use of equipment by toddy collectors in harvesting their tuba product. Actual assessment should be done on the food safety practices of the toddy collectors in terms of proper hygiene, use of facilities, equipment sanitation, and process control, since this study was limited only on the respondents' perceptions. National Government and Local Government Units (LGU's) have to find ways to support the marketing of our local product which will make a name in the food industry of Asian regions, that could also generate the income of the farmers, coconut toddy owners and toddy collectors. An independent group of researchers should conduct a similar study to prove the conclusion of the respondents reflection in their perception. Finally, an action plan for the integration of food safety should be included in the Science curriculum. Particularly in the Grade 5 level since majority of the respondents have reached this level in the elementary. The role of the teacher as guide in the teaching-learning situation is important in the success of such action plan.

REFERENCES

Abbas, K. A., and Lasekan, O. (2010). Flavor Chemistry of Palm Toddy and Palm Juice: A Review. Trends Food Sci. Technol.

Bureau of Product Standards. (2010). Philippine National Standard. Recommended code of practice for the processing of and handling of tropical fruit wines. Philippines: Department of Trade and Industry.

Codex Alimentarius Commission (2005). Code

of Hygienic Practice for Meat. CAC/RCP 58/2005. http:www.codexalimentarius.net/download/standards/10196/CXP_058e.pdf.

Codex Alimentarius Commission (Hg) (1999). Principles and Guidelines for the Conduct of Microbiological Risk Assessment. CAC/GL 30-1999.

Codex Code of Hygienic Practice for Fresh Fruits and Vegetables. CAC/RCP 53-2003.

Codex Recommended International Code of Practice – General Principles of Food Hygiene. CAC/RCP 1-1969. Rev 4:2003.

Collins, M.D., Phillips, B.A., & Zanoni, P. (1989). Deoxyribonucleic acid homology studies of lactobacillus casei, lactobacillus paracasei sp. Nov., subsp. Paracasei & subsp. Tolerans, & lactobacillus rhamnosus sp. Nov., comb. Nov. International Journal of Systematic Bacteriology, 39 (105-108).

Cruickshank, J.G. (1990). Food Handlers and Food Poisoning: Training Programmes are Best. British Medical Journal, 300 (6719), 207-208.

DOH, Nov. 2008. Health Policy Notes. "Assuring Food Safety in the BFAD Strengthening Program: A Collective Will" Vol.3: Issue 4. P. 1-6.

Egan, M.B., Raats, M.M., Grubb, S.M., Eves, A., Lumbers, M.L., Dean, M.S., Adams, M.R. (2007). A review of food safety and food hygiene training studies in the commercial sector. Food Control 18. Elsevier Ltd. 1180-1190.

Eva, Annabella P. (October 2011). "Extent of Stress and Utilization of Coping Strategies of Parents of Children with Down Syndrome: Basis for a Stress-Coping Program". Dissertation. Foundation University.

Frazier, William C. and Westhoff, Dennis C. (1998). Food Microbiologu, 4th Ed. McGraw-Hill Book Company, Singapore, International Edition.

FAO (Food & Agriculture Organization) (1998). Fermented Fruits & Vegetables. A Global Perspective. Agricultural Services Bulletin of Food & Agricultural Organization. Food & Agriculture Organization of the United Nations Rome, p.134.

FAO. (2006). Food Safety Risk Analysis. A Guide for National Food Safety Authorities. FAO Food Nutrition. paper87. p104.

FDA. (2009b). Produce safety: safe handling of raw produce & fresh-squeezed fruit & vegetable juice. Available from US Food & Drug Administration: (http://www.fda.gov/Food/ResourcesForYou/consumers/ucm114299). Posted July 30, 2009.

Food Safety Unit, World Health Organization. Poster. Five keys to safer food (WHO document WHO/SDE/PHE/POS/01.1). Geneva, Switzerland: World Health Organization, 2001.

Henderson, S., Kosatsky, T., McIntyre, L., Vallaster, L., Wilcott, L. (2012). Food Control. Vol. 30. Issue 1. Evaluation of food safety knowledge, attitudes and self-reported hand washing practices in FOODSAFE trained and untrained food handlers in British Columbia, Canada. Elsevier Ltd. 150-156.

Howes, M., McEwan, S., Griffiths, M., and Harris, L. (1996). Food Handler Certification by Home Study: Measuring Changes in Knowledge and Behaviour. Dairy, Food and Environmental Sanitation, 16 (11), 737-744.

Lasekan, O., Buettner, A., and Christlbauer, M. (2007). Investigation of important odorants of palm wine (Elaeis guineensis). Food Chem., 105(1): 15-23.

Manel, Ziadi; Sana, M'hir; Nedia, Kbaier; Moktar, Hamdi; and Ali, Ferchichi. (23 September 2011). "Microbiological analysis and screening of lactic acid bacteria from Tunisian date palm sap". African Journal of Microbiology Research Vol. 5(19), pp. 2929-2935.

Martin, R.C., Sexton, C., Franklin, T., Gerlovich, J., and McElroy, D. Pearson Allyn Bacon Prentice Hall. www.education.com/reference/article/science attitudes.

McElroy, D.M. and Cutter, C.N. (2004). "Self-report changes in food safety practices as a result of participation in a statewide food safety certification program". Food Protection Trends, 24, 150-161.

Mira, Evangeline T. (March 2013). 'Level of Science-Related Attitude of Selected Senior High School Students of Siaton District, Negros Oriental in Relation to Their Academic Performance in Science". Thesis. Foundation University.

PCARRD. FARMNEWS. (January-March 2011). "Coco Sugar: The Low Glycemic Sweetener". Volume XXXVI, Vol.1, ISSN 0116-9491. PCARRD, DOST.

PCARRD. (Jan.-Mar. 2011). Profitability analysis: Coconut sap sugar production module. PFN No. 6805. PCARRD, DOST. Los Baños, Laguna. 3-4.
PCARRD. (Jan.-Mar. 2011). Profitability analysis: Coconut sap sugar production module. PFN No. 6806. PCARRD, DOST. Los Baños, Laguna. 5-7.

Philippine Coconut Authority. http://pca.da.gov.ph

Philippine National Standard (PNS). (2014). Code of Hygienic Practices for Equipment and Utensils. p.6.

Philippine National Standard (PNS). (2014). Code of Hygienic Practices for Harvesting Techniques. p.4.

Sanchez, Priscilla C. (2008). Philippine fermented foods: principles and technology. UP Press.

Sevilla, Consuelo G. et al. (2006). General psychology with Values Development Lessons. 4th Edition. Rex book Store. Print.

Tauxe, R.V. (1997). Emerging Foodborne Disease, An Evolving Public Health Challenge. Emerging Infectious Diseases, 3 (4), 425-434.

WHO (World Health Organization) (2002). World health report 2002: reducing risks, promoting healthy life. Geneva: WHO. Available from http://www.who.int/whr/2002/en/summary_riskfactors_chp4.pdf.Accessed February 2011.