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Are risky behaviors associated with tattoos? The association of tattooing with non-sexual health risk behaviors among Filipino college students

Jose Ma. Joaquin B. Buñag, Gail B. Burgos, Peter Jared Michael F. Caballes, Rachel Jean S. Cabangon, Von Merrylou D. Cabanilla, Paolo Miguel Y. Cabero, Juan Carlo M. Cacao, Daniella Marie L. Cagampan, Ma. Antonette P. Calipjo, Reubenne A. Candelario, Jacqueline D. Canoza, Kenneth E. Cantalejo, Carolyn Pia Jerez-Bagain, MD,[1] Gerald Caesar O. Libranda, MD,[2] and Leopoldo P. Sison Jr., MD, MPH[3]

Abstract

Introduction The study aimed to determine the association of body tattooing and health risk behaviors among young adult Filipinos in a university in Metro Manila, as previous studies have linked tattooing to health risk behaviors such as alcoholism, violence, suicidality, illegal drug use and smoking.

Methods A convenience sample of students enrolled in randomly selected colleges from a university were recruited for the study. Researchers administered the Youth Risk Behavior Survey to the participants. Prevalence rate ratios were computed, and chi-square was utilized to test for significance and strength of association of the variables mentioned.

Results Among the risk behaviors studied, only smoking had a significant association with tattooing, with tattooed individuals being two times more likely to be engaged in smoking. Alcoholism, violence, suicidality and illegal drug use did not show significant associations with tattooing.

Conclusion The presence of body tattoos was associated with increased engagement in smoking behaviors, though the association between tattooing and other risk behaviors should be further explored.

Keywords: Tattooing, health risk behaviors, risk-taking

Correspondence:
Leopoldo P. Sison, Jr, MD, MPH, Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc., 64 Aurora Boulevard, Barangay Doña Imelda, Quezon City, PH 1113; e-mail: lpsisonjr@uerm.edu.ph

[1] Department of Pharmacology, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc.
[2] Department of Physiology, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc.
[3] Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc.

Tattoos and body piercings have gained resurgence in popularity in modern society. A study on body modification practices among adolescents in Western cultures showed that the prevalence among Americans between the ages of 18 and 50 years was 24%, and was 19.4% among German young adults.[1] Tattooing, while associated with rebellious attitudes in the past, is now regarded as an expression of young adults' individuality, self-esteem and independence. However, several studies have shown associations between tattooing and a range of risk behaviors, including alcoholism, suicidality, illegal drug abuse and smoking.[2-6]

Gaps in the understanding of the association of tattooing with young adult health risk behavior still exist in the Asian and Philippine contexts. There has been an attempt to understand young adult health risk behavior through the Young Adult Fertility Survey of the University of the Philippines Population Institute, in coordination with the Demographic Research and Development Foundation, done every four years since 1982. However, this focused mainly on sexual risk behaviors instead of an overall understanding of young adult health risk behaviors. On the other hand, a more comprehensive tool, the Youth Risk Behavior Survey from the Centers for Disease Control and Prevention, has yet to be used in an Asian setting. No local studies have been conducted using this tool to explore the association of tattooing with risk-taking behaviors among young adults.

This study sought to fill this dearth in the literature on health risk behaviors by applying the Youth Risk Behavior Survey in the Philippine context, focusing on key health risk behaviors more prevalent in the country. The study aimed to explore the association between tattooing and alcohol abuse, violence, suicidality, illegal drug use and smoking. The results of this study may confirm or challenge the findings of Western studies on tattooing and risk behaviors among young adults. Results may also help readers understand the context of young adults and develop health programs that will address the health risk behaviors.

Methods

The study utilized a cross-sectional design which explored the association between tattoos and health risk behaviors like alcohol abuse, violence, suicide, illegal drug use and smoking among college students from a university in Metro Manila in August 2018.

The study used a convenience sample of students from several randomly selected colleges in the university. Interested students were met by the research team and oriented about the study. Informed consent was obtained from those who opted to participate and met the inclusion criteria, which were: 1) currently enrolled as a bona fide student of the university and 2) aged 18 to 30 years. The minimum required sample size was computed as 164 based on the confidence level of 95% power of 80% based on the study by Caroll.[7] A 20% buffer was added to compensate for dropouts, resulting in a sample size of 190 to 200 respondents.

A positive tattooing status was defined in the study as the presence of at least one permanent body tattoo. For risk behaviors, definitions of the terms and the rating per item from the Youth Risk Behavior Survey formulated by the Centers for Disease Control (CDC) were utilized. Alcohol abuse was defined as the consumption of alcoholic substances exceeding four or more bottles within a few hours for females, and five or more for a few hours for males for each week in a month. Violence or violent behavior was defined as possession and use of weapons, coercion, engaging in physical fights in or out of school property. Suicidality referred to the tendency of individuals to commit suicide, whether it was only thought of (ideation) or attempted. Drug abuse was the consumption of illegal substances such as marijuana, heroin or methamphetamines. Smoking referred to the use of nicotinic substances such as cigarettes, vape, e-cigarettes or tobacco.

The Youth Risk Behavior Survey, a 92-item questionnaire which was originally designed for use among a high school American audience, was utilized in this study. It contained subsets of questions for alcohol abuse (4 items), violence (6 items), suicide (5 items), drug abuse (13 items) and smoking (9 items). A respondent was considered high risk for a specific behavior if he/she scored one or more in that specific subset. Several studies have demonstrated its utility among college age populations.[9,10]

Completed questionnaires were encoded and the data gathered from the survey were processed and subjected to different analyses using SPSS for Windows. The frequency distributions of the variables was calculated for descriptive analysis including sex and age. Chi-square analyses were done to determine

if there were significant associations with alcohol abuse, violence, suicidality, illegal substance use and smoking. A p-value of 0.05 was used as the level of significance in the chi-square tests. Prevalence rate ratio was computed on significant associations to determine their strength.

The study protocol was approved by the Ethics Review Committee. Confidentiality and anonymity were maintained using codes for each participant.

Results

A total of 190 students were recruited from the different colleges of the university where the study was conducted. Three respondents submitted questionnaires with incomplete answers, leaving 187 for the analysis. As shown in Table 1, less than 10% of the participants had tattoos, and the tattooed participants were significantly older than the non-tattooed respondents ($p = 0.008$). There was no significant difference in the sex distribution between the tattooed and non-tattooed groups.

As shown in Tables 2 to 5, the odds that students with tattoos would engage in the risk behaviors studied were not significantly different from the chance that students without tattoos would engage in the same risk behaviors: alcohol abuse (PRR = 0.3, $p = 0.116$), violent behavior (PRR = 0.29, $p = 0.060$), suicide (PRR = 0.69, $p = 0.200$) and illegal drug use (PRR = 0.60, $p = 0.106$). The results showed that participants with tattoos were 2.5 times more likely to smoke than those without tattoos (PRR = 2.51, $p < 0.001$), as seen in Table 6.

Discussion

The social significance of tattooing has evolved through time, with recent studies linking tattooing with a number of risk behaviors among young adults.[3,4] Tattooed individuals have been shown to have increased likelihood for alcoholism, illicit drug use, eating disorders, self-harm and smoking.[2-4,7,8] These behaviors may have serious health implications especially on the young adult population who seem to be most vulnerable in engaging in these practices.[9,10] Hence, this study explored the association between tattooing and health risk behaviors using the Youth Risk Behavior Survey applied to college students in a university in Metro Manila. The study focused on five non-sexual risk behaviors from YRBS and their association with tattooing. Results of the study revealed that among the risk behaviors studied, only smoking had a significant association with the presence of tattoos.

Table 2. Association of tattooing and alcohol abuse among 187 participants

	High risk	Low risk	Prevalence rate ratio
Tattooed	1	10	0.36 (p = 0.116)*
Non-tattooed	44	132	
Total	45	142	
Total prevalence	24.1%	75.9%	

* Chi-square test

Table 3. Association of tattooing and violent behavior among 187 participants

	High risk	Low risk	Prevalence rate ratio
Tattooed	1	10	0.29 (p = 0.059)*
Non-tattooed	55	121	
Total	56	131	
Total prevalence	31.5%	68.5%	

* Chi-square test

Table 1. Comparison of demographic characteristics between tattooed and non-tattooed participants (n = 187)

Demographic variable	Tattooed	Non-tattooed	Total	p-value
Age (yr)				
Mean ± SD	21. 6 ± 2.65	19.9 ± 1.71	20.7	0.008
Range			18 – 31	
Sex				0.184
Male	5	82	87 (46.5%)	
Female	6	94	100 (53.5%)	

Table 4. Association of tattooing and suicide among 187 participants

	High risk	Low risk	Prevalence rate ratio
Tattooed	3	7	0.69 (p = 0.200)*
Non-tattooed	77	100	
Total	80	107	
Total prevalence	42.7%	57.3%	

* Chi-square test

Table 5. Association of tattooing and illegal drug use among 187 participants

	High risk	Low risk	Prevalence rate ratio
Tattooed	3	7	0.60 (p = 0.106)*
Non-tattooed	89	88	
Total	92	95	
Total prevalence	49.2%	50.8%	

* Chi-square test

Table 6. Association of tattooing and smoking among 187 participants

	High risk	Low risk	Prevalence rate ratio
Tattooed	11	0	2.51 (p < 0.001)*
Non-tattooed	70	106	
Total	81	106	
Total prevalence	43.3%	56.7%	

* Fischer's exact test

The prevalence of tattoos among the sample was 5.9%, which is markedly lower compared to Western studies which consistently indicate a tattoo prevalence range of 20-25% among undergraduates in American universities.[11-13] However, the disparity between these prevalence rates may be explained by cultural differences as well as methods in data collection. Western cultures may be more permissive and receptive to tattooing among students, while Filipino young adult students may be more conservative and less inclined to have themselves tattooed. It has been demonstrated that exposure to, access to and acceptance of tattooing may be less among Asian college students as compared to their American counterparts.[14] The convenience sampling method employed by this study may have affected the true prevalence of tattooing among the students sampled.

The study failed to demonstrate any significant differences between alcohol abuse prevalence among tattooed and non-tattooed individuals, which is inconsistent with the findings of other studies.[2] A possible explanation for this finding is that Filipino young adults may have the same propensity for alcohol abuse, regardless of tattooing status. In this study, the prevalence of alcohol abuse in Filipino young adults was 24.5%, similar to the prevalence rate of 22.8% found in a study by Mekonen in a university population.[15]

No significant association between tattooing and violence was demonstrated in the study, which is consistent with findings from previous studies and contradicts the common media stereotype of tattooed persons being more violent compared to their non-tattooed counterparts.[5,6] There was no significant association between tattooing and suicide, which does not support previous findings by Stirn and Hinz.[3] Furthermore, there was also no significant association between tattooing and all forms of illegal drug abuse measured in the YRBS, in contrast with the findings of Martins.[4]

In this study, tattooing status and smoking were found to be significantly associated ($p < 0.001$), with a prevalence rate ratio of 2.51, which means that tattooed individuals are more than two times more likely to smoke compared to their non-tattooed counterparts. These findings confirm the literature on the association of tattooing and smoking.[5] A possible explanation for such a relationship may be attributed to the social and cultural acceptance of smoking as compared to the other health risk behaviors. Currently, it is easier, less stigmatizing, and less expensive to access cigarettes compared to alcohol and illegal substances. Smoking might be more popular and accessible to Filipino young adults, making this an important and prevalent health risk behavior.

It is important to emphasize the prevalence of health risk behaviors in vulnerable populations like young adults because these may persist even through their adulthood. Health programs will benefit from an annual assessment of such risk behaviors and tattoos can be a good tool to screen for possible risk-prone individuals.

Findings of this study are limited to the population sampled, specifically, young adults in a university in

Metro Manila. Future research studies can explore other dimensions of health risk behaviors or study other populations. Regardless of the presence of absence of tattoos, health risk behaviors among young adults should routinely be monitored. Tattooing only provides a handle on identifying possible health risk-prone individuals but health programs should continually conduct and refine their health assessments to reduce health risk among young adults. Tattooing is part of the Philippine cultural heritage and over the years has developed into an artistic vehicle of self-expression and group identification. However, several studies have linked tattooing to various health risk behaviors. This study aimed to determine the presence of associations between tattooing and certain health risk behaviors, including alcohol abuse, violence, suicide, illegal drug abuse and smoking. Results showed that of the risk behaviors studied, smoking was significantly associated with tattooing, with tattooed young adults being twice more likely to smoke compared to non-tattooed young adults. The other health risk behaviors were not significantly associated with tattooing.

The investigators recommend qualitative studies to explore the experience and reasons of participants in getting body tattoos -- which may be helpful in characterizing the current cultural and social significance of body tattoos. Other quantitative studies utilizing different populations may also be considered to further understand the association of tattoos with various health risk behaviors.

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The effects of binaural beats stimulation compared to classical music on the memory of senior high school students: A randomized controlled trial

Jeo Renzo B. Cortez; Sharmaine S. Chua; Miguel Jose J. Cid; Cesar Ian T. Claro; Jessica Regina S. Claveria; Chantelle Vianca D. Cobarrubias; Miguel Deo G. Colasito; Jan Angela V. Conda; Elliene Justine R. Conejos; Kristell Ann L. Constantino; Frances May L. Coralde; Charina Bianca B. Cortez and Jose Ronilo G. Juangco, MD, MPH[1]

Abstract

Introduction Several studies have suggested that music has a significant effect on memory. Classical music has been studied extensively. However, there are studies on other types of music like binaural beats which involve the introduction of tones of different frequencies. This study aimed to determine the effects of binaural beats stimulation compared to classical music on memory among high school students.

Methods This was a randomized single-blind controlled trial among senior high school students in a selected private school assigned to listen to either binaural beats stimulation or classical music to determine their effect on memory as measured by the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Pre- and post-intervention RBANS scores were compared within and between the two study groups.

Results RBANS scores in both classical music and binaural beats stimulation groups improved with an increase of 20.58 ± 10.33 and 20.26 ± 12.06, respectively. The difference between the increase in scores was not significant.

Conclusion Exposure to either binaural beats stimulation or classical music provided statistically and clinically significant increases in memory. Binaural beats stimulation increased memory to the same degree as classical music.

Keywords: Binaural beats, music, memory, RBANS

Due to the advancement of science and technology, new discoveries challenge a person's capacity to remember information. There is a search for options to enhance memory, most especially for students. Among these options, classical music has been established as a memory enhancer, particularly of specific memory.[1] On the other hand, binaural beats stimulation is a type of auditory sensory stimulation which involves tones of different frequencies in each ear producing waves affecting cortical functioning similar to waves that are present in learning and memory encoding processes.[2,3] The Repeatable Battery for the Assessment of

Correspondence:
Jose Ronilo G. Juangco, MD, MPH, Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center Inc., 64 Aurora Boulevard, Barangay Doña Imelda, Quezon City, PH 1113; e-mail: jgjuangco@uerm.edu.ph

[1] Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc.

Neuropsychological Status (RBANS) is a standardized screening tool for assessment of neuropsychological status that includes domains like immediate and delayed memory.[4,5]

The general objective of the study was to determine the effects of binaural beats stimulation and classical music on the memory of senior high school students in a selected private school with the use of RBANS scores. The study also aimed to determine if there is a significant change in the pre-test and post-test scores of each group and if there is a significant difference in the change in scores between the classical music and binaural beats stimulation groups.

Methods

This was a randomized single-blind controlled trial among senior high school students in a selected private school assigned to listen to either binaural beats or classical music to determine their effect on memory as measured by the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Pre- and post-intervention RBANS scores were compared within and between the two study groups. The study was approved by the UERMMMCI Research Institute for Health Sciences Ethics Review Committee. Informed consent and assent, when applicable, were obtained from the participants.

Binaural beats stimulation was a 15-minute sound recording composed of a two-toned auditory sound at 130 Hz tone on the right ear and a 125 Hz tone on the left ear. Listening to such frequencies produced a 5 Hz difference in brain wave activity. Classical music was a 15-minute excerpt from Vivaldi's Four Seasons "Spring Movement". Memory was measured using RBANS index scores as converted by a clinical psychologist (CDM) to a total scale index score ranging from 40 - 160.

Participants were selected from senior high school students enrolled for school year 2018-2019 under the STEM program of a selected private school who were 15 to 19 years old, had a minimum sleep of seven hours, and a Mini Mental Status Examination score of at least 24. Those who were repeaters, had taken alcoholic beverages within the previous 24 hours, had known neurological disorders, or had ear/hearing problems were excluded. The minimum required sample size was 33 per group based on 95% confidence, 80% power, variation of 52.85 (S1) and 33.41 (S2) and mean scores of 83.93 (μ1) and 79.4 (μ2) based on the pilot study on 30 students conducted by the researchers. The 30 students in the pilot study were included in the sample.

The participants were randomly allocated using Random Allocation Software version 1.0.0 to listen to 15 minutes of binaural beats stimulation or classical music for five consecutive days under the supervision of the researchers. The listening sessions were continued unless an adverse effect was experienced or there was withdrawal of consent. All underwent a pre-intervention RBANS administered by researchers blinded to the group assignments. A licensed clinical psychologist (CDM) trained the researchers to administer the RBANS, which was conducted in a controlled airconditioned room, free from noise and distraction, provided by the school. Daily monitoring of sleep and substance use was conducted prior to each listening session. To ensure safety of the participants, monitoring for headache and dizziness prior to each listening session until two weeks after the study was done. A post-intervention RBANS was administered by researchers blinded to the group assignments after the last listening session on the fifth day.

The RBANS is a standardized tool commonly used to assess neurological and cognitive function among those who had suffered traumatic head injuries, strokes, and for elderly assessed for dementia.[5] It is also used as a screening tool for the cognitive performance of younger individuals. This is composed of five major cognitive appendices (immediate memory, visuospatial, language, attention and delayed memory) with consequent subtests for each index. The sum of the raw index scores were computed and converted to an RBANS total scale index score from 40 to 160. Index scores were classified as follows: very superior (130 and above), superior (120-129), high average (110-119), average (90-109), low average (80-89), borderline (70-79) and extremely low (69 and below).

It has a split-half reliability coefficient of 0.80 for internal consistency. It was also reported to have a total reliability score of 0.82 to 0.88 in different test-retest studies. RBANS total score correlated at 0.79 to composite z scores from 22 standard measures of IQ, memory, motor, attention, language and executive function.[6] The subtests immediate memory, attention, language and delayed memory had test-retest reliability scores of 0.71 to 0.80 with the visuospatial component being an outlier with a score of 0.63. The total, corrected for age test-retest reliability, remains adequate at a corrected coefficient of 0.85.[6,7]

To determine comparability of the two groups, a chi-square test was used to detect significant differences in sex and year level, and an independent t-test was done for the age and average pretest RBANS score. The RBANS raw scores obtained from the pre-test and post-test were submitted to a psychometrician (CDM) who converted them to RBANS index scores per major cognitive appendix which were added to get the total index score and then converted to the total scale. The pre-test RBANS scores were further grouped according to classification. In comparing the pre-test and post-test RBANS scores of the classical and binaural groups, statistical significance was measured using a two-tailed paired t-test. In comparing the change in RBANS scores of binaural beats and classical music, statistical significance was measured using an independent t-test. The level of significance was set at $\alpha = 0.05$.

Results

Seventy-six senior high school students were randomly assigned to either binaural beat stimulation or classical music group. The mean age for both groups was 16 years. There were more male than female participants in the binaural beat stimulation group, while the opposite was true for the classical music group. More than half of the participants in both groups were in the 12th Grade. The baseline RBANS scores of both groups ranged from average to extremely low. The mean pretest RBANS scores of the binaural beats stimulation group was higher (84.37 vs 79.16). There was no significant difference between the two groups, in terms of age, sex distribution, grade level as well as majority of the pretest RBANS score strata except for the average stratum as seen in Table 1.

For the pre-test of classical music stimulation, the mean RBANS score was 79.16, with the highest at 94 and the lowest at 60. The mean posttest RBANS score was 99.74 with the highest at 127 and the lowest at 79 with one outlier (Figure 1). For the pretest of binaural beats stimulation, the mean RBANS score was 84.37 with the highest at 102 and the lowest at 66 with four outliers. The mean posttest RBANS score was 104.60 with the highest at 128 and the lowest at 75 with one outlier (Figure 2).

As shown in Table 2, the posttest test scores for both binaural beats stimulation and classical music groups were significantly higher than their respective baselines. There was no significant difference in the improvement in RBANS scores between the two groups ($p > 0.05$). There were no significant

Table 1. Baseline demographic characteristics of the participants

Characteristic	Binaural beats n (%)	Classical music n (%)	p-value
Age (yr ± SD)	16.7 ± 0.79	16.8 ± 0.86	0.677[1]
Sex			
Male	20 (52.6)	15 (39.5)	0.250[2]
Female	18 (47.4)	23 (60.5)	
Grade level			
11	17 (44.7)	15 (39.5)	0.642[2]
12	21 (55.3)	23 (60.5)	
RBANS pretest score	84.37 ± 8.41	79.16 ± 8.59	
A	96.72	91.75	0.015[1]
LA	84.87	84.00	0.291[1]
B	75.40	75.10	0.860[1]
EL	66.67	66.00	0.781[1]

[1] Independent t-test for two-sample means
[2] Chi-square test of independence
A = Average; LA = Low average; B = Borderline; EL = Extremely low

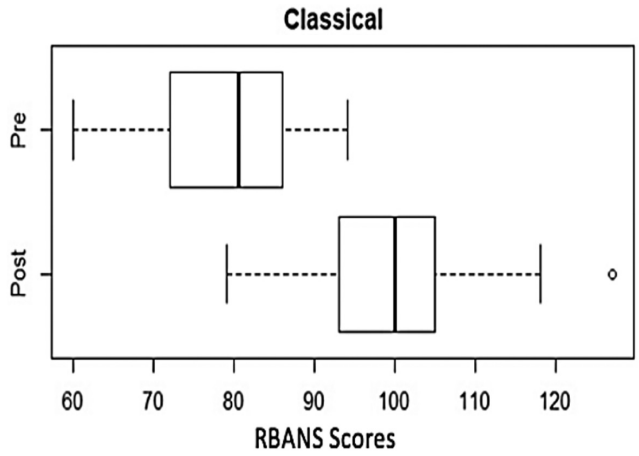

Figure 1. Boxplot of pretest and post-test of classical music stimulation

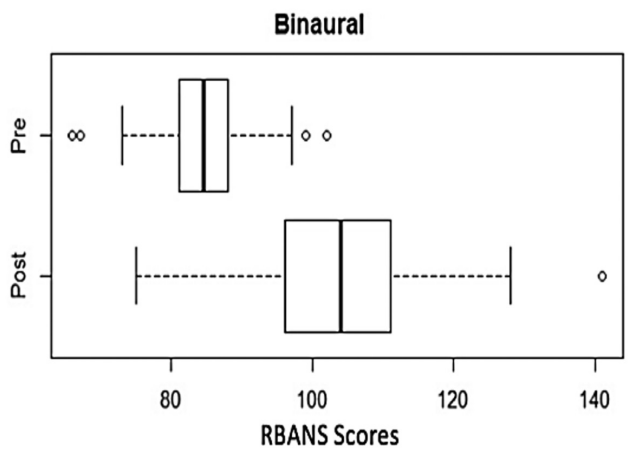

Figure 2. Boxplot of pretest and post-test of binaural beats stimulation

Table 2. Comparison of pretest and posttest RBANS scores of binaural beats stimulation and classical music groups

Group\RBANS score (mean ± SD)	Pretest	Posttest	Difference	p-value
Binaural beats	84.37 ± 8.41	104.60 ± 12.79	20.26 ± 12.06	< 0.001
Classical music	79.16 ± 8.59	99.74 ± 10.63	20.58 ± 10.33	< 0.001
			p > 0.05	

differences between binaural beats stimulation and classical music participants who obtained low average, borderline, and extremely low RBANS scores.

Discussion

Binaural beats stimulation is an auditory sensory stimulation which involves the introduction of tones of different frequencies in each ear. The difference of these two frequencies would have a resultant frequency like that of a theta wave, affecting cortical functioning. To illustrate, 5Hz stimulation would result from listening to 130 Hz on one ear and 135 Hz in the other ear.[2] In a study by Ortiz, the 5Hz stimulation showed a significant increase in the number of words recalled.[8] Theta waves present in learning and memory encoding fall at the range of 4-7Hz. Stimulation using binaural beats resulted in an increase in the RBANS score of the participants.

This may be attributed to the simulation of theta waves preserved along the pathway towards the auditory cortex by virtue of periodic neural firing with respect to the binaural beat frequency.[9] Theta waves oscillate through different parts of the brain.[3] Interactions between these areas of the brain have been strongly associated with working memory performance and retrieval.[9]

The effect of classical music on memory has been studied to a greater extent compared to binaural beats stimulation. This is known as the Vivaldi or Mozart effect: a belief that when a person is exposed to classical music, there would be increased cognitive performance on measures of spatial reasoning and autobiographical memories (e.g., recall).[10] This is further supported in a study that found an increase in autobiographical memories after listening to Vivaldi's "Spring" movement.[10] Nicolas Sulicki concluded that participants who listened to classical music were able to recall more words than participants who had silence as their background, supporting previous suggestions that the short-term effects of listening to classical music on spatial ability are an artifact of

arousal and mood.[11] This can be correlated to this study, where classical music stimulation led to an increase in the RBANS score of the participants. This may be explained by the link between increased levels of dopamine, its effect on positive moods, and the production of norepinephrine with which arousal is strongly associated. Therefore, enjoyable stimuli induce a positive affect and a heightened level of arousal, which lead to modest improvements in performance on a variety of tasks.[12]

The results of this study are consistent with existing literature in documenting that stimulation with either binaural beats or classical music can increase memory.[13,14] An analysis of the improvements in scores between binaural beats stimulation and classical music gives depth to this data since both means are greater than 15 which makes them clinically significant, and it supports the findings in memory enhancement.[4]

The results show that binaural beats stimulation is comparable with classical music at improving memory. With the extensive literature on the utility of classical music on improving memory, it is then promising that binaural beats may be a comparable alternative to the already proven classical music. To the authors' knowledge, there are no published studies yet that compare binaural beats to classical music.

Exposure to either binaural beats or classical music provided statistically and clinically significant increases in memory. Binaural beats increased memory to the same degree as classical music.

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Factors affecting availment of Expanded Z-MORPH Program in an urban community-based rehabilitation center: A mixed methods study

Cybil Brigitta P. Kwok, Timothy Christian M. Aromin, Anna Katrina D. Bongalonta, Ian Carlo G. Medina, John Lemuel A. Balatucan, PTRP[1], Alyssa Joyce D. Gorgonio, CPO[1], Jerome B. Lovidad, PTRP, CPO,[1] Jose Ronilo G. Juangco, MD, MPH[2]

Abstract

Introduction Community-based rehabilitation, a strategy executed by the local government, aims to improve access by providing rehabilitation, ensuring social inclusion and equalizing rights among persons with disabilities in the community in developing countries. Believing in the same idea, the Philippine Health Insurance Corporation (PhilHealth) seeks to reintegrate persons with physical disabilities into the community by rendering affordable prosthetic and orthotic services and materialized the Expanded Z-MORPH Program. Unfortunately, the program only has few to exiguous number of availers as of 2016 with limited studies done. Therefore, the study aims to determine the factors that affect how the persons with disabilities (PWD) avail of the Expanded Z–MORPH Program in an urban community-based rehabilitation center in the Philippines.

Methods The study uses a Quantitative-Qualitative mixed study design. A cross sectional study was conducted involving the Barangay Health Workers (BHWs) and PWDs in Barangay 185 Malaria, Caloocan City, using a questionnaire on the possible factors affecting the utilization of Expanded Z-MORPH Program gathered using related literature. A Case Study of the community was done for the qualitative aspect using focus group discussions to further delve into the details of the factors identified in the quantitative results. Descriptive analysis using frequency and proportion was used for the quantitative design, while thematic analysis was used for the qualitative design.

Correspondence:
John Lemuel A. Balatucan, PTRP, Philippine School of Prosthetics and Orthotics, College of Allied Rehabilitation Sciences, University of the East Ramon Magsaysay Memorial Medical Center, Inc., 64 Aurora Boulevard, Barangay Doña Imelda, Quezon City, PH 1113; e-mail: jabalatucan@uerm.edu.ph

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[1] Philippine School of Prosthetics and Orthotics, College of Allied Rehabilitation Sciences, University of the East Ramon Magsaysay Memorial Medical Center, Inc.
[2] Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc.

Results The results are written and categorized into two parts, namely: Quantitative (derived from the yes/no questionnaire) and Qualitative (derived from the focus group discussions). The quantitative data was not computed for the researchers were not able to gather respondents who availed for the program due to the absence of availers in the community. Therefore, lack of transportation, PhilHealth membership and dissemination of information about the program, BHW's dissemination of information, awareness of community about P.T. and P&O services, awareness to the program, family support, hospital accreditations and health-seeking behavior are factors affecting availment of Expanded Z-MORPH Program in an urban community-based rehabilitation center in the Philippines.

Conclusion The determined factors linked to government logistics as the main contributing factor for both PWD and BHW discussions. This plays an important role in resolving these concerns since the administration manages PhilHealth correlating it to the implemented national policy about disability addressing most of the factors.

Keywords: Disabled persons, rehabilitation centers, community-based rehabilitation, health insurance, Expanded Z-MORPH Program

According to the National Statistics Office's 2010 Census of Population and Housing (CPH), 1,442,587 (1.57%) out of the 92.1 million population had some form of disability.[1] The 2010 CPH classified disability into six types, these are functional difficulty in seeing, hearing, walking, remembering, self-caring and communicating. The number of households with at least one member having a functional difficulty in seeing is 1,315,149; in hearing - 466,679; in walking - 543,365; in remembering - 314,406; in self-caring - 229,851 and in hearing communicating - 260,287.[1] Furthermore, major lower extremity amputations remain a significant source of disability.[2]

The World Health Organization (WHO) initiated a new approach called community-based rehabilitation (CBR) in order to provide rehabilitation, ensure social inclusion and equalize rights of persons with disabilities (PWD) among people in the community.[3] Through the combined efforts of PWDs, their families, communities, and relevant governmental and non-governmental health, education, social, vocational and other services, solutions are now being discussed and prioritized.

Believing the same cause, the Philippine Health Insurance Corporation (PhilHealth) recognizes the potential towards functional independence and the productivity of PWDs, particularly those people with limb loss, deficiency and/or deformity. Aligned with the Republic Act 7277 or the Magna Carta for Disabled Persons, PhilHealth sought to mainstream and reintegrate persons with physical disabilities into the community by rendering prosthetic services available to the PhilHealth members, especially those whose conditions are considered economically-medically "catastrophic".[4]

These illnesses push many into poverty even as PhilHealth works to provide relevant financial risk protection especially for the members who belong to the lower income levels. With a national support value of 20 to 33%, PhilHealth members, particularly the poor, are often deprived of quality care necessary to attain better health outcomes.[5]

PhilHealth conceptualized the Expanded Z-Mobility Orthosis Rehabilitation Prosthesis Health (Z-MORPH) program that offers prostheses, orthoprostheses and orthoses.[4] Unfortunately, the program only has had few availers as of 2016, with limited studies done. The study aimed to determine the factors that affect how PWDs avail of the Expanded Z-MORPH Program in an urban community-based rehabilitation center.

Methods

The research setting of the study was Barangay 185 Malaria, Caloocan City; it has had an established CBR center since 2007, including a room for physical therapy and prosthetic and orthotic rehabilitation. It had 13 active patients who were physically qualified to avail of the Expanded Z-MORPH Program as of 2017 to 2018. The CBR center was manned by two supportive Barangay Health Workers (BHWs).

The researchers selected and included respondents who were 1) PWDs currently residing in Barangay

185 Malaria, Caloocan City who were physically eligible to avail for the "Z-Benefits" of the Expanded Z-MORPH Program, 2) trained and certified BHWs of Barangay 185 Malaria, Caloocan City, and 3) any family member or legal guardian of the PWD of legal age and qualified to represent him/her. The researchers excluded those with poor cognition and who refused to sign the informed consent form.

The research used a mixed method study design – a combination of cross-sectional study (quantitative) and a case study (qualitative) using thematic analysis approach. The study followed an explanatory sequential, in which the quantitative research data was analyzed first and an explanation thru qualitative research was done afterwards.

A self-administered questionnaire was used for the cross-sectional study to collect the necessary quantitative data — what factors the respondents believed affected the availment of the Expanded Z-MORPH Program. This was needed to set the categories to ask prior to the qualitative aspect of the study. The qualitative aspect of this study employed a focus group discussion (FGD) to delve into how the factors were experienced by the participants. The resulting qualitative data were primarily verbal and derived meaning from the participants' perspectives. It ultimately aimed to expand knowledge on the factors limiting the program's availment in the area. The process employed a memoing and coding of themes not aimed to generalize but to understand and interpret the meanings and intentions that motivated the urban community dwellers' actions and decisions, particularly in their availment of the Expanded Z-MORPH Program.

The study was approved by the Ethics Review Committee of the UERMMMCI Research Institute for Health Sciences. Participant recruitment and data collection were conducted within nine months. Informed consent was obtained from all the respondents. All information gathered were kept confidential and were handled without any identifying reference to the participants.

Results

The results are categorized into two parts: quantitative (through the yes/no questionnaire) and qualitative (through the focus group discussions).

Quantitative Results

Out of the 13 active PWDs and two BHWs in the barangay, majority were males and stroke patients, as seen in Table 1. All respondents were non-availers of the Expanded Z-MORPH Program.

The main factors shown in the study affecting the availment of Expanded Z-MORPH Program from the perspective of the PWDs and BHWs were problems related to transportation (85%), PhilHealth dissemination of information about the program (70%), BHW's dissemination of information (62%), and health-seeking behavior (62%) as seen in Table 2. Another factor was the lengthy pre-authorization processes. The respondents were divided on awareness of community about PT and P&O services. Among the factors listed, the least significant was PhilHealth membership.

Table 1. Characteristics of 13 respondents

Sex	Codename	Medical Diagnosis
Female	PWD 1	Transfemoral amputation
Male	PWD 2	Stroke
Male	PWD 3	Congenital unilateral lower limb deformity
Female	PWD 4	Congenital unilateral lower limb deformity
Male	PWD 5	Idiopathic unilateral lower limb deformity
Male	PWD 6	Transradial amputation
Male	PWD 7	Post-poliomyelitis syndrome
Male	PWD 8	Stroke
Male	PWD 9	Stroke
Female	PWD 10	Stroke
Female	PWD 11	Stroke
Male	PWD 12	Bilateral lower limb weakness
Male	PWD 13	Stroke

Table 2. Quantitative survey summary of PWDs and BHWS

Factor	Yes	No
Lack of transportation	11	2
PhilHealth's dissemination of information	9	4
PhilHealth membership	6	7
Lengthy pre-authorization process	7	5
BHW's efforts on information dissemination	8	3
Awareness about PT & PO services	7	6
Health-seeking behavior	8	5

Qualitative Results

Out of fifteen respondents from the quantitative aspect of the study, five PWD participants were available to attend the FGD. One was not able to attend due to work, another because of personal issues, and the rest could not be contacted. Both BHWs attended their separate FGD.

BHW Thematic Analysis. In relation to transportation as a factor, the researchers formulated four codes including fare, discrimination, ignorance and discount. *"Sir unang-una, yung disabled walang pamasahe. Number one 'yun e..."* (BHW1). *"Yes, sir at saka yung pagsakay-sakay ng mga jeep na minsan daw maluha-luha siya kasi talaga sir ang hirap... yan lalagpasan sila. Pauusukan pa daw sila minsan, sir..."* (BHW1). *"Sir, siguro nasa gobyerno 'yun para sa akin kasi kahit na kunware sa bus, may nakalagay na 'For Disabled Only' na nasa harapan, diba? Pero hindi din naman nasusunod..."* (BHW1).

In relation to *PhilHealth efforts* as a factor, the researchers formulated information dissemination as a code. *"Maidagdag ko diyan yung information campaign. Dapat ay mas malaman ng mga disabled natin na mayroon palang ganitong programa ang gobyerno..."* (BHW1). According to the responses of the participants, they would like PhilHealth and government agencies to maximize their information campaigns because according to them, only a few hospitals are accredited, thus, more effort should be exerted to promote these limited facilities.

In relation to awareness as a factor, the researchers formulated information dissemination and location as a code. *Di ko alam kung saan kukuha ng PhilHealth... onti lang nakakaalam noon..."* (BHW2). Some respondents believe that the application of Expanded Z-MORPH Program lacks sufficient promotion in terms of location and PhilHealth was not able to make the mandate of the health facility services clear to the people.

In relation to *PhilHelath membership* as a factor, the researchers formulated two codes including regulation of information and validity of information. *"Sabi nila priority lane eh 'di rin naman nasunod yung priority lane…"* (BHW1). *"Eh syempre sir, mas maganda kalusugan mo kapag wala kang PhilHealth… Hindi po ba?"* (BHW1).

In relation to family support as a factor, the researchers formulated two codes including disability and financial assistance, based statements such as the following: *"Malaki rin ang tulong ng mga kamag-anak. Hindi naman ako makagalaw masyado ng mabuti, hindi ako makahanap ng trabaho…"* (BHW2). *"Bibigyan ka ng pamasahe… Kagaya nung sa anak ko, sinusuportahan nila ako dati. Noong wala akong pera, binibigyan nila ako."* (BHW2). BHWs said that some PWDs were helped financially by their family and other relatives.

In relation to overall health as a factor, the researchers formulated two codes including disability and validity of information. "*Kasi karamihan naman ng mga disabled walang trabaho at walang pinagaralan kaya walang pinagkukuhanan ng pera..."* (BHW2). The BHWs said that the patient's disability was a factor in getting employed.

PWD Thematic Analysis. In relation to transportation as a factor, the researchers formulated three codes including inaccessbility, location and validity information. *"Sana may malapit dito na pwede ko namang lakarin"* (PWD 1). According to respondents, the only accredited hospital near them which caters to the Expanded Z-MORPH Program is UERM Hospital. Travel time back and forth usually takes hours for them; there is also scarcity of means of transportation as only buses and jeepneys are available.

In relation to PhilHealth factors, the researchers formulated three codes including lack of information, regulation of information and validity information. "*Unang-una po limited yung alam mo. Kunwari naputulan ka ng paa, 'di mo alam magkano ibabayad mo"* (PWD 3). According to them, there were no seminars or lectures of any kind in their area, but some considered the inaccessibility of the place and not PhilHealth's lack of effort in disseminating the information as a factor.

In relation to PhilHealth Membership as a factor, the researchers formulated two codes including lack

of information and validity of information. "*Need mo muna ma-check up or ma-confine bago mo magamit ang PhilHealth"* (PWD2). In relation to pre-authorization process as a factor, the researchers formulated two codes including requirements and validity of information. "K*ung hindi kumpleto application mo, 'di mo maa-avail yung ganong services"* (PWD 1). In relation to BHWs efforts as a factor, the researchers formulated lack of volunteers. *"Katulad dito, sa amin dito mga bigay ni ma'am Celia na magsabi sa kanya *hand gestures* oh ito ibigay mo 'to"* (PWD 4).

In relation to family support as a factor, the researchers formulated disability as a code. "*Eh kung may anak akong sasama, baka makakuha ako non. Kailangan ko pa ng may kasama."* (PWD 3).

In relation to Awareness as a factor, the researchers formulated lack of information as a code. *"BB: "Paano niyo po nalaman yung mga ginagawa ng PT at PO?" PWD 2: Dito po sa CBR".*

In relation to over-all health as a factor, the researchers formulated two codes including willingness and disability. *"Dapat pursigido ka"* (PWD 1). PWDs voiced that they should be willing and determined to undergo rehabilitation and learn to use a prosthesis.

Discussion

The factors affecting availment of Expanded Z-MORPH Program have not been investigated as much as the other programs of PhilHealth. All factors that were stated in the quantitative part have been considered and were further discussed in the qualitative part of the study for both PWDs and BHWs. The discussions made during the FGD of BHWs were considered supplementary to the discussions made during the FGD of PWDs. As one study recommended, acknowledging community and government factors such as initiative in disseminating information at a community level, level of the general public's awareness, and number of BHWs could help explain the behavior of the PWDs.[6]

Transportation is a significant factor affecting availment of the Expanded Z-MORPH Program because It is important to consider the journey cycle for a better understanding and experience the whole journey of accessibility for disabled; it also helps to know the problems faced by a PWDs.[7] According to a local study, one of the main reasons is financial difficulties to cover transportation costs. Another study stated that service providers' (public transportation) attitude plays a vital role in eradicating discrimination against PWDs.[8] The government services may play a great role in resolving the dilemma regarding ignorance of the public. As stated in a related literature, the Ministry of Health needs to define a clear policy on social participation and operational methods in facilitating community health projects.[9]

Under the *PhilHealth factor*, PhilHealth's efforts on *dissemination of information* about Expanded Z-MORPH Program was also considered. Furthermore, as part of its efforts to provide the public and media with information on the National Health Insurance Program (NHIP), its services, policies and benefits and programs such as the Expanded Z-MORPH Program, PhilHealth launched MOVES (Mobile Orientation, Validation and Enrolment Scheme), a series of lectures and other promotional activities in different localities.[10] Published literature has also shown a lack of interest in acting on health matters among people negatively affects their availment of services.[8] Information on CBR was distributed extensively through the barangay captains, health workers, day care workers and volunteers. As an outcome, people are more aware of the everyday issues faced by PWDs.[11]

Studies have shown that people with no or limited education could not read the contents of the Magna Carta for Disabled Persons, restricting its usefulness to educated people.[8] The same also applies to PWDs with no or limited education in availing of the Expanded Z-MORPH Program.

PhilHealth membership is a crucial factor as the respondents believed that they could only avail of the Expanded Z-MORPH Program if they were members. The processing of applications took two months or more. The respondents said that it took them one year to avail of the program and it was not a one-time application process. Factors such as unclear/incomplete requirements resulting in the PWD having to go to the PhilHealth office repeatedly further delayed the processing.

According to respondent PWDs, *Barangay Health Workers' efforts in disseminating information* about the Expanded Z-MOPRH Program was a contributing factor affecting availment of the program because only one out of four BHWs was active in their community, but even though there was only one active BHW in their community, the BHW was able to disseminate information about the programs. The BHWs are a vital part of the referral system because they serve as

the link of the community to the hospitals accredited by the PhilHealth, especially for initiating pre-authorization process to avail of the programs or packages.[12]

Awareness about physical therapy and prosthetics and orthotics services as a factor affecting availment of Expanded Z-MORPH Program was also considered by some of the respondents. Most respondents were not aware of the inherent and intimate involvement of physical therapy in the program; most of the responses were only about the nature of the expertise and not the relationship between the program and physical therapy.

Under personal factors, familial support was a factor affecting availment of Expanded Z-MORPH Program. A person with a disability usually makes additional demands on the family's financial resources as the family may have to provide for medical care, prosthetic aids and appliances, special educational services, transport costs.[13] Respondents reported that prompting of family members and relatives influenced their decision to avail of the services. Health-seeking behavior was also considered as a factor affecting availment of Expanded Z-MORPH Program because a positive outlook towards health may help the respondents persist to achieve the highest possible level of fitness, wellness and functionality. Without the said factor, a PWD may not mind his/her personal health and further complications may arise. According to an analysis by the DOH, attitudinal barriers like poor seeking health behaviors, stigmatization, unresponsive health workers are threats to the availment of health services.[14]

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A cross-sectional study on the knowledge, attitude and practices (KAP) of mothers and caregivers on immunization in Quezon City

Ryana Anjela D. Quero, Pamela Agatha A. Puno, Anne Marie P. Qua, Robert John T. Quiroz, Timothy Jorge L. Quenery, Pristine Joy B. Polido, Lia Veronique S. Priela, Gunjan V. Prithiani, Melvin V. Prudente Jr., Joselle C. Pua and Grace E. Brizuela, MD, MSPH[1]

Abstract

Introduction Despite establishing immunization as an effective approach, the number of deaths from immunizable diseases among 0 to 14 years old remained high in 2012. This prompted the researchers to determine the knowledge, attitude and practices of mothers/caregivers regarding the immunization of their children.

Methods The research utilized a descriptive cross-sectional design. An interviewer-guided validated questionnaire was administered to mothers and caregivers with at least one child 12 months or younger who was eligible for immunization.

Results Around half of the 211 respondents were aged 20-35 years old, married and living in their own home. A large percentage were unemployed, and the highest educational attainment was high school. Most respondents had one child in care undergoing immunization, mostly in a health center. Results showed that all respondents scored below the MPL for knowledge. For attitude, all scored above the MPL. Only 45.02% of mothers/caregivers scored above the MPL for practices.

Conclusion Despite poor knowledge, mothers and caregivers displayed good attitude towards immunization, however this did not translate into bringing their children for vaccination.

Keywords: Immunization, vaccination, knowledge, attitude and practices

Correspondence:
Grace E. Brizuela, MD, MSPH, Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc., 64 Aurora Boulevard, Barangay Doña Imelda, Quezon City, PH 1113; e-mail: gebrizue-la@uerm.edu.ph

1st place, poster presentation, The Philippine Academy of Family Physicians Research Forum, March 9, 2019, Philippine International Convention Center

Dean Fernando S. Sanchez Research and Publication Award, 21st Annual Research Forum, UERMMMCI Research Institute for Health Sciences, April 30, 2019, UERMMMCI, Quezon City

[1] Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc.

The Expanded Program on Immunization (EPI), a project of the World Health Organization (WHO), was created to ensure that children and mothers have access to recommended vaccines.[1] In the Philippines, free vaccines for the recommended immunizations are available all year long in public health centers. The fully immunized child must have had one dose of BCG vaccine, three doses each of diphtheria-pertussis-tetanus (DPT), oral polio and hepatitis B vaccines and one dose of measles vaccine before the child is 12 months old.[2] However, in 2011, according to UNICEF, millions of children died from diseases that could have been prevented with readily available vaccines.[3] In 2012, the Philippine Statistics Authority reported that the highest number of deaths among 0 to 14 years old from vaccine-preventable diseases was

due to all forms of tuberculosis, followed by tetanus.[4] A local study revealed that "the greatest maternal constraints to adherence in Expanded Program in Immunization (EPI) are misconception and lack of knowledge about vaccination."[5]

There is a need to strengthen the promotion of patient safety, most especially of children against vaccine-preventable diseases in the country. This prompted the researchers to determine the knowledge, attitude and practices of mothers and caregivers regarding the immunization of their children, in order to provide data on the current understanding of the immunization program and identify possible barriers to achieving better rates of fully immunized children. This could provide a basis for improving the government's immunization program.

Methods

The research utilized a descriptive cross-sectional design. An interviewer-guided Knowledge, Attitude and Practices of Mothers on Immunization Questionnaire (KAPMCIQ) was developed by the researchers which was an adaptation of validated tools.[11,12] The tool was translated, validated and pretested on 30 women. The computed item-level and scale-level content validity indices (I-CVI and S-CVI) were 0.98 and 0.92, respectively. The overall reliability of the questionnaire computed using Cronbach's alpha was 0.70. The minimum passing level (MPL) for each domain was computed by a panel of experts using the modified Angoff method. The computed MPL for knowledge, attitude and practices were 84.65, 88.65 and 89.08, respectively.

Using convenience sampling, mothers and caregivers in District 4, Quezon City, who consented to participate and who had at least one child eligible for Expanded Program on Immunization (EPI): healthy infants ≤ 1 year of age, with no known contraindications for receiving the recommended vaccines, including BCG, three doses of pentavalent, three doses of polio and one dose of measles vaccine, at recommended schedules, until the age of 12 months were enrolled. The child may have been fully or partially vaccinated at the time of the survey. Those excluded were mothers and caregivers of infants were delivered preterm.

A caregiver was an adult 18 years or older who, in the absence of the mother, had primary responsibility for a child eligible for immunization and was with the child more than 8 hours daily for most days of the week; this was regardless of that person's sex and relationship with the child. A mother or caregiver was considered to have good knowledge, positive attitude or good practice if he/she scored above the minimum passing level (MPL) for that domain. He/she was considered to have poor knowledge, negative attitude or poor practice if he/she scored below the MPL for that domain. An infant was considered fully vaccinated if he/she had received all vaccines recommended for his/her age in months, as determined through the report of the mother or caregiver. An infant was considered partially vaccinated if he/she had missed at least one dose of the recommended vaccines.

The analysis was done using SPSS version 16.0. Descriptive statistics were used. Classification of the variables was determined based the computed MPL scores.

Results

There was a total of 211 respondents where three-fourths were mothers (78.7%). Around half of the respondents were aged 20-34 years old (56.9%), married (43.1%) and living in their own homes (58.3%). Moreover, 66.8% of the respondents were unemployed, 63.5% completed education up to high school level. Furthermore, only 8% of the respondents declared a household income of more than PHP 15,000, and there were 16 respondents who classified themselves as having no permanent address (Table 1). More than 90% of the respondents had only one child in care undergoing immunization mostly at health centers. Majority of the mothers and caregivers (64.9%) walked to the place of immunization, taking them less than 15 minutes to get there (78.8%); majority of those who commuted (58.1%) took less than 10 minutes to reach the location.

Knowledge Though the participants had a generally correct response for individual questions, all the total scores were below the MPL of 84.65. Thus, the overall knowledge scores were classified as poor (Table 2). Half of the respondents (53.5%) knew that children should complete the vaccination program when they reached one year of age. Less than half (41.2%) knew that there is no alternate to prevent vaccine preventable diseases. Information such as BCG vaccine is used to prevent tuberculosis, that OPV vaccine keeps the country polio-free and that chicken pox is not a vaccine-preventable disease

initially included in the EPI were not known to most of the respondents.

Nine of 10 respondents had a misconception that vaccine should not be given to a child with fever up to 38.5ºC and/or if the child is malnourished. Two respondents had not heard any information about vaccination; the rest heard about it mainly through their friends and health professionals. More than 80% of the respondents were knowledgeable on the importance of vaccination, were aware that they could visit the health center more than once and that there was more than one disease that could be prevented

Table 1. Summary of predominant sociodemographic characteristics of respondents

Characteristics	Predominant response	Percentage (%)
Relationship to child	Mother	78.7
Age category of mother/ caregiver	20-34	56.9
Total number of children/ children under their care	2-3	46.0
Total number of ≤ 1 children/ children under their care	1	88.6
Total number of ≤ 1 child/ children under their care undergoing immunization	1	90.1
Place of immunization	Health center	92.8
Marital status	Married	43.1
Mother's/caregiver's occupation	Unemployed	66.8
Mother's/caregiver's education	High school graduate	63.5
Household's monthly income	5,000-10,000 PHP	35.1
Type of housing	Owned	58.3
Means of transportation	On foot	64.9
Time taken to health centers (on foot)	< 15 minutes	78.8
Time taken to health centers (vehicles)	< 10 minutes	58.1

Table 2. Summary of respondents' predominant knowledge towards immunization

Variable	Proportion with correct response (%)	Predominant	Answers Percentage (%)	Classification
Information heard about vaccination	99.1	Yes	99.1	Right
Informed of the importance of vaccination	88.6	Yes	88.6	Right
Infants should start vaccination	69.2	Just after birth	69.2	Right
Awareness of more than 1 visit to the health center	94.3	Yes	94.3	Right
Sessions needed to complete vaccination	79.2	More than 4 or 5	79.2	Right
Age of infant to complete its vaccination program	53.6	Greater than or equal to 1 year	53.6	Right
Number of vaccine preventable diseases mentioned by respondents	85.3	More than one disease	85.3	Right
Alternative mechanism to prevent infants from vaccine preventable disease	41.2	Yes	58.8	Wrong
Free vaccination in health centers	96.2	Yes	96.2	Right
Vaccination requirement for every child	91.5	Yes	91.5	Right
Is fever up to 38.5ºC and malnutrition a contraindication to vaccine?	9.9	True	90.1	Wrong
What vaccine is given to prevent tuberculosis?	66.8	BCG	45.5	Right
What is a common side effect after getting measles vaccine?	72.0	Fever and rashes	72.0	Right
What vaccine keeps the Philippines polio-free?	41.7	OPV	41.7	Right
What vaccine or vaccines is/are given to the child after birth?	77.2	BCG and Hepatitis B	77.2	Right
What vaccine-preventable disease was NOT initially included in the EPI?	37.9	Chicken Pox	37.9	Right

depending on the vaccine the child was receiving. These respondents were also aware that vaccines were free when given at health centers and vaccines were required for every child. Furthermore, 60% to 80% of the participants correctly answered when the vaccination should start, how many sessions are needed to complete the program, what the side effects of a measles vaccine are, and what vaccine(s) is/are given to child after birth.

Attitude Majority of the participants had a positive attitude. Total scores of the mothers and caregivers were above the MPL of 88.65 (Table 3). Almost all mothers (97.2%) had a favorable opinion towards immunization. For positive statements such as "I am motivated to continue and finish the child's vaccination", "immunization prevents diseases", "immunization is important for infants" and "I have positive attitude towards professionals", more than 95% had positive responses. Around 80 to 88% of the respondents also correctly disagreed with some statements in negative format such as "vaccination side effects are dangerous", "vaccination will not work or have no use", "vaccination makes infants sick", and "vaccination can cause death in infants." However, only 60% of mothers and caregivers correctly disagreed with a few negative statements, such as "infants took usually too many vaccines", "immunization is important only for non-serious diseases", and "vaccinators do experiments on infants."

Practices Fewer than half of mothers and caregivers (45.02%) scored above the MPL of 89.08. In relation to the total scores, there was an almost equal proportion of good and poor overall vaccination practices (Table 4). At least 90% of the respondents had an EPI card and were using it. They also made sure that their child got vaccinated as soon as possible after a missed dose and that child would continue the vaccination program even if they transferred residence. There were 83.4% respondents who brought their child for vaccination on the first week of life. However, only a little over half (59.7%) of the caregivers confirmed that their ward received BCG vaccine by searching for the scar.

Total Scores For the knowledge section of the questionnaire, all the respondents scored below the MPL. For the attitude part, all respondents scored above the MPL. For the third component, 56% of the mothers and 51% of the caregivers were classified as having poor practices, since their scores were below the MPL. For the combined mothers' and caregivers' scores, only 45% scored above the MPL (Table 5).

Discussion

Knowledge Despite the total scores equating to poor knowledge in majority of the respondents were aware of general information on vaccination. More than 95% of participants knew about the vaccination program in the health center. Health professionals were the

Table 3. Summary of respondents' predominant attitude towards immunization

Variable	Proportion with correct response (%)	Predominant	Answers Percentage (%)	Classification
I have favorable opinion on immunization	97.2	Agree	97.2	Positive
I am motivated to continue and finish the child's vaccination	96.7	Agree	96.7	Positive
Infants usually took too many vaccines	68.2	Disagree	68.2	Positive
Immunization prevents diseases	96.7	Agree	96.7	Positive
Immunization is important for infants	94.8	Agree	94.8	Positive
Immunization is important only for non-serious diseases	65.9	Disagree	65.9	Positive
Vaccination side effects are dangerous	84.4	Disagree	84.4	Positive
Vaccination will not work or have no use	88.2	Disagree	88.2	Positive
Vaccination makes infants sick	88.2	Disagree	88.2	Positive
Vaccination can cause death in infants	82.9	Disagree	82.9	Positive
I have positive attitude towards professionals	94.3	Agree	94.3	Positive
Vaccinators do experiments on infants	66.8	Disagree	66.8	Positive

Table 4. Summary of respondents' predominant practice towards immunization

Variable	Proportion with correct response (%)	Predominant	Answers Percentage (%)	Classification
Confirming BCG vaccination	59.7	Checking scar	59.7	Good
Availability of EPI card during vaccination	94.3	Yes	94.3	Good
Infant immunization practice always by use of EPI card	95.7	Yes	95.7	Good
Immunization status of infants: Took vaccines appropriate at 1st year of age	83.4	Yes	83.4	Good
Getting child vaccinated soon after a missed dose	91.5	Yes	91.5	Good
Still get child vaccinated, even if transferred to another barangay	97.2	Yes	97.2	Good

Table 5. Scores of respondents in relation with MPL

Section	Response percentage (%)	Scores relative to MPL	Conclusion
Knowledge	100%	Below	Poor
Attitude	100%	Above	Positive
Practices	56.0% mothers and 51.1% caregivers	Below	Poor
	45.0% combined mothers and caregivers	Above	

most common source of information, followed by friends and their child's school. This is congruent with previous researches where information regarding infant immunization came from barangay health workers and professionals.[6,9,10] Regardless of the source of information, majority of the participants were aware of the importance of vaccination.[9] The significance of this result was also highlighted in a study which showed that there is a significant probability of having an unvaccinated child among mothers who did not see the importance of immunization.[11] Studies showed that the main reason for partial and non-immunization was lack of information and knowledge.[12,13]

A high percentage of participants correctly identified that vaccination begins just after the birth of an infant, comparable with results of another study.[6] A quarter of the respondents reported that the vaccination should begin after the baby turned one month old, while the rest had no knowledge. The significance of not knowing when the first dose of vaccine should be given is that the child loses the opportunity to be protected at the earliest time, when it is most needed and most effective.

The proportion of participants who responded that there were more than 4 or 5 sessions needed to complete the vaccination of an infant is higher than a study done abroad where less than half knew this frequency.[6] Majority of the respondents correctly answered that the infant should be completely vaccinated by the time it turns one year old, in contrast with another study where majority of the participants stated that vaccinations should be completed before the infant turns one year old.[6]

A greater number of respondents believed that more than one disease can be prevented through vaccination. While 16 participants indicated that they did not know the answer, this data showed that lack of knowledge about vaccination is a huge challenge in the Philippines, as previously stated in a study.[5] Though a majority of the participants reported that there was an alternative to prevent infants from developing vaccine-preventable diseases, 41% thought otherwise and is a significant percentage. Majority of the mothers and/or caregivers are aware that vaccines are free when given at health centers and are required for every child.

On their knowledge about general contraindications to vaccination, it was reflected that a significant percentage were misinformed that fever of up to 38.5°C and malnutrition were contraindications to vaccination. More than half of the respondents

were aware that fever and rashes are common side effects of administering the measles vaccine.[14] Less than half of the respondents knew that OPV is the vaccine responsible for eradicating polio. Twenty-five percent of the respondents believed that the vaccine for diphtheria, pertussis and tetanus was DPT. Only a few were aware that chicken pox was not initially included in the Expanded Program of Immunization (EPI). Despite that, most of the mothers and/or caregivers were aware that BCG and Hepatitis B are vaccines that must be given to the child after birth. However, only 45.5% knew that BCG was the vaccine given to prevent tuberculosis.

This showed that respondents did not place much attention to the history and/or components of EPI program, as well as the diseases they prevent/eradicate. This could lead to blind compliance to the program, which could easily be shaken when controversies arise. The risk of this is a possible decrease in rate of vaccination of children because of inadequate/misinformed knowledge of mothers and caregivers.

Attitude Almost all mothers had a favorable opinion about immunization, accounting for their motivation for their children to complete the vaccination. This was similar to the result of the study which reported that the probability of having an unvaccinated child is more significant in women who are not able to point out the importance of immunization.[11] Since the results of the study showed that majority of the mothers knew the importance of vaccination, majority were also willing to complete their children's vaccination.

Practices Though there was an almost equal distribution of good and poor overall vaccination practices, the total scores of majority of the respondents leaned towards the negative side. Despite mothers and caregivers being aware that vaccines are free in health centers, this did not translate into practice. However, most of them claimed that their infant's immunization was appropriate for their age. If a child missed a dose, 9 of 10 mothers and caregivers would get them vaccinated as soon as possible. Moreover, 97% of respondents said that they would still have their child vaccinated even if they transferred to another barangay. This would decrease the incidence of unvaccinated children, even if their families moved to another place.

More than 90% of the respondents brought and used their EPI cards during their infants' vaccination. The important contents of the EPI card include mother and infant identification, vaccines appropriate for the age of the infant, together with their schedule and important notes written by the health care professional conducting the vaccination. If the mother/caregiver knew and used the EPI card, it would ensure the timeliness of vaccination and would guide other health care providers on what vaccine the infant would need in the future.[1]

The only vaccine confirmation asked in the questionnaire was about BCG vaccine. Majority reported that their way to confirm BCG vaccination was through the scar. Literature underscored that improvement in knowledge and attitudes of mothers/caregivers regarding immunization resulted to better practices and higher vaccination rates.[15,16] This same trend was also seen in the results of this research.

In conclusion, despite poor knowledge, mothers and caregivers displayed good attitude towards immunization, however this did not translate into them bringing their children for vaccination. Thus, improving their understanding of vaccination may be needed, in order to translate this generally positive attitude into practice.

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Comparative study: Banana-polyester fiber with guava extract (GuaBaNIKA sock) as an alternative to cotton in prosthetic socks

Krisha Kate T. Tansiongco, Alexander L. Abellon, Iris Cecile M. Ambatali, Nicko Sean S. Cantiga and Marichelle A.de Castro, RN, CPO

Abstract

Introduction Skin problems are commonly reported by amputees due to perspiration discomfort inside the prosthesis. Cotton is commonly used in prosthetic socks but its properties are not ideal. This study compared the banana-polyester sock dyed with guava extract (GuaBaNIKA) and cotton socks in terms of air permeability, absorbency and antibacterial activity.

Methods This was a quantitative quasi-experimental study that compared GuaBaNIKA and cotton socks in terms of air permeability, absorbency and antibacterial activity using standard tests. Fibers from banana pseudostem were mixed with polyester, processed into yarn then fabric and dyed with guava leaf extract. Air permeability was analyzed using Mann-Whitney U Test and descriptive analysis was used for absorbency and antibacterial activity.

Results The mean air permeability for GuaBaNIKA was significantly higher than that of cotton (295.5 vs 112.7 $cm^3/s/cm^2$). The air permeability scores were higher in GuaBaNIKA in all 10 specimens tested. GuaBaNIKA absorbed water faster than cotton (< 1 vs > 60 seconds). Both GuaBaNIKA and cotton knit socks did not produce a zone of inhibition.

Conclusion GuaBaNIKA is more absorbent and permeable than cotton but did not exhibit antibacterial activity. GuaBaNIKA has the potential to be an alternative to cotton in prosthetic socks.

Keywords: Amputation stumps, prostheses and implants, thermal discomfort, prosthetic sock

Correspondence:
Marichelle A.de Castro, RN, CPO. Philippine School of Prosthetics and Orthotics, College of Allied Rehabilitation Sciences, University of the East Ramon Magsaysay Memorial Medical Center, 64 Aurora Boulevard, Barangay Doña Imelda, Quezon City; e-mail: madecastro@uerm.edu.ph

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Skin problems are commonly reported by amputees who use prostheses. Figures on the global incidence of dermatological problems caused by perspiration in the residual limb are not readily available.[1] There are studies which investigated the prevalence of skin problems due to perspiration discomfort. Muelenbelt found that among Dutch lower limb amputees, of the 82% who reported having skin problems, 32% were due to excessive sweating.[2] Another study found that the reduction in quality of life of 72% of their

participants was perspiration discomfort inside the prosthetic socket.[3] This affected the overall comfort of the amputees and might have added to the risk of damaging skin integrity resulting to temporary disuse of the device.[2]

Inappropriate ventilation within the socket contributes to majority of skin problems. A typical prosthesis has multiple layers that cover residual limbs. Prosthetic socks prevent air and moisture from causing skin irritations within such multi-layers.[4-7] Several options have been used to enhance the properties of this interface such as the use of aloe vera, mineral oil and vitamin E to promote skin health. However, these liners are costly. Enhancement with silver nanoparticles is now widely used as coating and finishing of liners and socks to obtain antibacterial property which also helps in addressing skin related problems caused by different bacteria.[8-10] However, despite its antibacterial property, it has been found that wash-out silver nanoparticles may cause harm.[11,12]

The Philippine School of Prosthetics and Orthotics uses prosthetic socks made from cotton. Cotton fabric has less absorbency and air permeability, and has the ability to retain moisture such as sweat, and oxygen that stimulate the growth and proliferation of bacteria.[13-17] This led the researchers to look for an alternative material that can be at par or even better in terms of antibacterial, air permeability and absorbency properties than cotton socks.

According to the Department of Agriculture, banana is the leading fruit grown in the Philippines.[18] Aside from being a source of food, natural fiber can also be obtained from the banana pseudo stem. It has been used in several countries to produce yarn, fertilizer, biochemicals, paper and handicraft due to its good properties.[19-21] Further-more, banana pseudostem fiber has been already proven to have excellent physical and chemical characteristics such as better fineness and spinnability than bamboo and ramie fiber, high moisture absorption, strength, lightweight, and is economical, which makes it a good material for producing textile products.[21-23] The use of guava leaf extract was incorporated in the study to inhibit the growth of bacteria as it has been proven to have an antibacterial effect in textile.[16,24-27] The purpose of the study was to compare the banana-polyester sock dyed with guava extract (GuaBaNIKA) and cotton socks in terms of air permeability, absorbency and antibacterial activity.

Methods

The researchers used a quantitative quasi-experimental design to fulfill the objectives of the study and consisted only of material testing. The study used sabá pseudo-stem as a raw material for GuaBaNIKA socks as it was the type of banana available in the private farmstead and according to a previous study, banana pseudo-stem can be used in producing fabric regardless of its type. Knitted socks that were 100% cotton was used as the comparator.

The production of GuaBaNIKA sock comprised seven different stages and it lasted for about 3 to 4 weeks. The researchers harvested the raw banana pseudo-stem and guava leaves from a private farmstead in Quezon City. The pseudo-stem was cut, and the outer layer and the center were removed as they could not be processed into fibers. It was divided into four one-meter long portions and put in a clean plastic bag to protect the pseudo-stem as moisture could make them vulnerable to pathogens. The guava leaves were placed in a separate plastic bag. The collected raw materials were sent within 24 hours to maintain their freshness to the Philippine Textile Research Institute (PTRI) of the Department of Science and Technology.

At the PTRI, the banana pseudo-stem underwent decortication to extract banana fiber (Figure 1), after which it underwent spinning to convert fibers into yarn. In the process of spinning, polyester was blended with the banana fiber to achieve a ratio of 80:20 (Figure 2). The yarn underwent a knitting process where it was turned into fabric called sock knit. During the dyeing process, the sock knit was cleaned by bleaching. Mordant was applied for the guava leaf extract --- which had been previously made by boiling the leaves for one hour --- to adhere to the sock knit. The sample was dipped and stirred in the guava leaf extract for another hour. The sock knit was hanged to dry and brought to the PTRI Testing Services Division to determine absorbency and air permeability and to the Industrial Technology Development Institute (ITDI) Standard Testing Division for the anti-bacterial test.

The banana-polyester sock knit with guava leaf extract (GuaBaNIKA) and the 100% cotton samples were cut according to the specified American Society for Testing and Materials (ASTM), American Association of Textile Chemists and Colorists (AATCC), and US Pharmacopeia (USP) dimensions and those required by ITDI and Technical Services Division. Sample size for each property was guided by

Figure 1. Banana fiber after decortication

Figure 2. Polyester-banana thread

related existing studies and supported by a manual of standard tests. According to Selvi 10 specimens were needed for testing air permeability, and five for testing absorbency. One specimen was needed for testing antibacterial activity.[28-31] Researchers were able to obtain the desired number of specimens and with the proper dimensions for both GuaBaNIKA and cotton sock knit.

The experimental and control samples underwent three different tests as follows:

Air permeability (ASTM D737). Test samples were placed into the machine. Air flow was set at 200 Pa and calibrated until the green light appeared. This was done at 21°C since simulation of the socket environment was not feasible. The test was repeated 10 times using different sections of the fabric to ensure that the results represented the whole sample.[32] The rate of air flow passing perpendicularly through the area under pressure was measured and recorded in SI units as $cm^3/s/cm^2$ and in inch-pound units as $ft^3/min/ft^2$ rounded to three decimal places. The average of all the samples was taken as the result for air permeability.[32]

Absorbency (AATCC 79). The test samples were examined in a standard atmosphere having a relative humidity of 65 ± 2% at 21 ± 1°C (70 ± 2°F) as required by the standard test with overhead lighting to know the end point of the test. The sample was mounted on the embroidery hoop to prevent wrinkles from forming and without deforming the structure of the fabric. The burette's stopcock was placed on 9.5 ± 1.0 mm from embroidery hoop in order to prevent mechanical force from acting on the sample. After setting up the fabric, distilled water was dropped from the burette as was required by the standard test (Figure 3). According to previous studies, this solution could simulate human perspiration.[28,33] The time when the reflection of the water was no longer seen was measured through observation by trained staff. The average time of the five samples was considered as the absorbency of the material. The shorter the time, the more absorbent the fabric is.[28]

Figure 3. Absorbency test of GuaBaNIKA sock knit

Antibacterial (USP 30-NF 25). The standard test assessed the antibacterial activity of the textile samples. Test samples were challenged with gram positive *Staphylococcus* aureus, one of the common pathogenic bacteria causing skin problems in residual limbs. The organism was inoculated into 10 mL tryptic soy broth and incubated overnight at 35°C. The agar plates were prepared by adjusting the overnight culture based on the turbidity to be comparable with the standard of McFarland. A 200-uL bacterial suspension was placed in a sterile Petri dish then 15-20 mL Mueller-Hinton agar was added; it was agitated until it was mixed well and allowed to solidify. A disc filter paper with samples was placed to the agar plates and incubated at 35°C.[34,35]

Reactivity and inhibitory activity, as measured through the zone of inhibition were rated. The reactivity rating was as follows: no zone of inhibition (0); slight zone of inhibition under the specimen, exact measurement was not specified (1); zone of inhibition limited under the specimen, exact measurement was not specified (2); zone of inhibition 5-10 mm from the specimen (3); and zone of inhibition > 10mm from the specimen (4). The inhibitory rating used was complete +++, partial ++, slight +, and negative (-).[34]

Mann-Whitney U test using Microsoft Excel 2017 was done to test the difference in air permeability between two independent samples gained from GuaBaNIKA and cotton socks as researchers could not meet the assumptions for a parametric test. The significance level was set as $p = 0.05$, with a confidence interval of 95%. Descriptive analysis was used to analyze the difference in absorbency and antibacterial properties of GuaBaNIKA and cotton socks as researchers did not meet the required sample for both parametric and non-parametric tests.

Results

Researchers were able to obtain enough samples with the prescribed size and dimension for both GuaBaNIKA and cotton sock knit. The mean air permeability for GuaBaNIKA (made from single yarn) was 295.5 $cm^3/s/cm^2$, higher than cotton made from multiple yarns (112.7 $cm^3/s/cm^2$). The difference was significant ($p < 0.001$). The air permeability scores were higher in all 10 specimens of GuaBaNIKA tested. GuaBaNIKA absorbed water in less than one second in five samples tested compared with more than 60 seconds for the cotton knit sock. Both GuaBaNIKA and cotton knit sock did not produce a zone of inhibition (reactivity 0, inhibition (-)). Both materials did not exhibit any bacteriostatic activity.

Discussion

According to Mansor, the ability of water vapor and air to pass through fabric is an important property in clothing as water mimics perspiration. With these two properties, comfort among wearers can be determined through standard testing. Similar with lower limb prosthetic users, good air flow and regulation of perspiration are factors in determining comfort among amputees and prevent skin irritations.[36]

In this study, a blend of banana-polyester was used to create new sock knit. These two raw materials are known for their good material properties such as high moisture absorbency and air permeability due to their porous structure. After analyzing the results, researchers found out that GuaBaNIKA sock knit absorbs moisture faster than cotton with a 60-second difference, implying that GuaBaNIKA is more absorbent than cotton. This may have been due to the knitting structure of the fabric, where GuaBaNIKA was made with only a single yarn unlike cotton which was made from multiple yarns. The result of the study was similar with that of Alay and Yilmaz where cotton was considered one of the least absorbent among different types of fabric tested.[37] However, different test methods were used to assess water absorption. Despite being more absorbent than cotton, it is important to test the overall moisture management of GuaBaNIKA sock knit to ensure that the ability to manage perspiration is mimicked.[37]

Air permeability enables the material to transport moisture vapor from the skin to the outside environment. This is important as it will help the prosthetic users to properly regulate the heat due to the compromised thermoregulation mechanism caused by the absence of some part of their limb. Sock knit with excellent air permeability has the potential to improve the breathability effect or the ventilation within the socket.[38] As the results show, GuaBaNIKA sock had significantly higher air permeability than cotton. Therefore, GuaBaNIKA sock can possibly facilitate adequate heat transmission and add comfort to the user. However, according to the previous studies, structural factors of the fiber can influence

the air permeability result.[38,39] Therefore, it might have affected the result of the study as the samples were made with different knitted structures. GuaBaNIKA sock was only made with single yarn unlike the cotton sock that was made with multiple yarns.

Furthermore, existing studies mentioned that bacterial growth is also a problem among prosthetic users due to the moist warm environment inside the socket. Hence, material with an antibacterial property could be advantageous. In this study, researchers used guava leaf extract similar with other studies, however the process of extraction and application (dye technique) to the sock knit was different and might have affected the outcome of the test.[24,26] After analyzing the results, researchers found out that although GuaBaNIKA sock knit was dyed with guava leaf extract, it was still not able to inhibit growth of *Staphylococcus aureus*. This implies that there is no difference between GuaBaNIKA and cotton sock knit in terms of antibacterial activity. Instead of the dyeing technique, researchers recommend the use of the printing method as used in other studies.

Aside from good air permeability and absorbency, there are other properties that a prosthetic sock should have for it to be used on actual patients. These include wash and dry, wickability, abrasion resistance, elongation, tensile strength and friction coefficient. Previous studies examined the duration of the effectiveness of the antibacterial property of a fabric. The bacterial reductions were measured after 0, 5, 20 and 50 wash cycles.[40,41] In another study, prosthetic sock was evaluated to measure its capillary pressure and permeability referred to as wickability; it is an important property as it mimics the rate at which the sweat is absorbed by the prosthetic sock and the rate it evaporates which in turn provides comfort.[33,6] Another study evaluated the ability of prosthetic sock to resist friction referred to as durability or abrasion resistance; it mimics the friction inside the socket which causes wear and tear thus a high value indicates more durability.[42,43] Moreover, a study evaluated the elongation and tensile strength of yarn by compression, twisting, bending and friction; the property mimics the stress forces applied on the fabric when used.[44] Lastly, the friction coefficient of fabric was computed in a study to assess its smoothness which relates to skin comfort inside the socket.[45]

To be able to recommend the use of GuaBaNIKA sock as an alternative to cotton, further material testing such as wash and dry, wickability, abrasion resistance, friction coefficient and elongation and tensile strength as well as changes in some methods are needed. The use of an industrial type of machinery is recommended to reduce the bias for the set parameters as the fabric structure influenced the results. In addition, due to the poor results of antibacterial testing the researchers recommend that future researchers consider using printing and pad-dry methods to incorporate the guava leaf extract into the fabric. Increasing the degumming solution is also recommended as this will improve the fineness of the fabric which is important for the texture of prosthetic sock.

In order to make the GuaBaNIKA sock feasible, researchers used banana fiber in combination with polyester, thus another trial must be made wherein the banana fiber is blended to another natural fiber to produce an eco-friendly fabric. In addition, GuaBaNIKA sock was only made with single yarn due to the availability of machinery which influenced the result of the study. Comparing different yarn counts is recommended. Simulating the environment of the prosthesis and the residuum is also important before testing it on humans to know the potential residual limb reactions and to ensure the patient's safety. Furthermore, setting a standard value of material properties for prosthetic socks is important due to limited resources regarding its use. This can be done by comparing the different varieties of prosthetic socks available including GuaBaNIKA sock.

Results showed that GuabaNIKA sock made from single yarn had higher air permeability and absorbency compared to cotton sock which was made from multiple yarns. These results indicate that yarn count may influence the properties of a sock knit. The fewer the yarn count, the more porous the fabric is which makes it to be permeable and absorbent. However, structure of the fabric is only one of the factors affecting its properties. Properties of the raw materials used might have also influenced the sock knit properties, wherein banana was proven to have good absorbency and air permeability properties and cotton was one of the least natural fibers in terms of those properties. However, it is not possible to determine whether the yarn count alone or the combination of the yarn count and the raw material properties led to results of the study. On the other hand, there was no zone of inhibition seen on the two samples during testing. This might be due to the dyeing process used for GuaBaNIKA sock. To finally prove that the GuaBaNIKA can be an alternative to cotton

sock, further material testing and change in knitting structure should be done.

GuaBaNIKA is more absorbent and permeable than cotton but did not exhibit antibacterial activity using the dye method to incorporate the guava extract. GuaBaNIKA has the potential to be an alternative to cotton in prosthetic socks depending on the results of further testing.

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Recycled plastics: An alternative material for prosthetic check socket fabrication

Feliz Nicole R. Arcilla, CPO; Anna Katrina M. Garcia, BPO; Marc Andre R. Sarthou, BPO;
Anna Margarita A. Lugue, PTRP, CPO; Andre Dominic M. Rubiano, CPO

Abstract

Introduction Polyethylene terephthalate glycol (PETG), the material used to fabricate prosthetic check sockets is expensive and not locally available. This study aimed to develop an alternative material for fabricating prosthetic check sockets. Specifically, it aimed to determine the material properties of the alternative and to compare it against the standard check socket, PETG.

Methods Alternative materials were made from recycled plastic bottles (PETR), sando bags (PER) and a plasticizer. A two-roll mill and a compression molder were used to fabricate the alternative materials. All samples were prepared and tested according to the American Society for Testing and Materials for each property test. Kruskal-Wallis test with post-hoc analysis of Mann-Whitney-U test was used for impact resistance test results while descriptive analysis was used for Vicat softening point and tensile strength test results.

Results PER performed well against PETR in all tests and exhibited acceptable Vicat softening point (126 vs 75°C) and impact resistance (235 vs 71 J/m) compared to the standard PETG. On the other hand, PETR performed poorly in all three tests: tensile strength (0 vs 56 MPa), Vicat softening point (0 vs 75°C) and impact resistance (20.3 vs 71 J/m).

Conclusion PER was shown to have acceptable properties as an alternative to the standard material. However, further testing must be implemented to improve its tensile strength.

Keywords: Prosthetic check socket, polyethylene terephthalate, polyethylene, recycled plastic bottle

The Philippines, producing almost three million metric tons of plastic garbage annually, is the third major contributor to leakage of plastic to the world's oceans.[1] In Manila alone, major portions (17%) of the total recyclable wastes are plastics and among these wastes, plastic bags and plastic bottles are the most abundant.[2] Polyethylene terephthalate (PET) is more commonly used for the production of plastic bottles while high density polyethylene (HDPE) is a material commonly used for manufacturing plastic trash bags and biomedical liquid containers.[3,4] Both plastics are a good moisture barrier, lightweight, transparent, easier to manufacture, and resistant to chemicals and ultraviolet rays which make them important for packaging.[5-9]

Plastics play an important role in the field of prosthetics and orthotics (PO), particularly in the fabrication of sockets, the part of the prosthesis which encloses the residual limb. Polyethylene terephthalate glycol (PETG) and HDPE are among the most

Correspondence:
Anna Margarita A. Lugue, PTRP, CPO, Philippine School of Prosthetics and Orthotics, College of Allied Rehabilitation Sciences, University of the East Ramon Magsaysay Memorial Medical Center, 64 Aurora Boulevard, Barangay Doña Imelda, Quezon City; e-mail: aalugue@uerm.edu.ph

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Philippine School of Prosthetics and Orthotics, College of Allied Rehabilitation Sciences, University of the East Ramon Magsaysay Memorial Medical Center

commonly used plastics in manufacturing check sockets.[8-10] Check sockets allows accurate inspection of the residual limb during fitting procedures.[11] Important properties that enable PETG and HDPE to fulfill check socket functions are 1) transparency, 2) Vicat softening point, 3) tensile strength, and 4) impact resistance.[5] Transparency allows the prosthetists to see how the residual limb of the patient fits within the socket and how pressures are distributed.[9,10,12] Vicat softening point determines the capability of PETG and HDPE to withstand being formed into variously shaped or sized prosthetic sockets and be further adjusted during fittings without easily melting.[8-15] Tensile strength and impact resistance are two properties that reflect the ability of sockets to withstand forces involved in weight bearing activities such as standing and walking.[8,16-17]

Despite being very useful in PO, PETG and HDPE limit its usability due to their unavailability in the country as these materials are imported from other countries.[8,9,18-20] Additional costs from shipment fee and import tax restrict its full utilization in Philippine settings.[21-22]

Mismanaged plastic waste brings about a steady increase of landfill waste, greenhouse gas and cost of plastic goods, which is why the applications of recycled plastic waste in material production have been given more attention.[23-31] Although PO institutions have yet to incorporate recycled plastic into prosthetic sockets, Prosthetic & Orthotic Component Clearinghouse (POCC), Limbs of Hope Foundation, and Ability Prosthetics & Orthotics with Physicians for Peace, recycle second hand devices and prosthetic components to repurpose them into prosthetic components that can be used to assemble new devices.[32-33] This concept of recycling and repurposing of plastic is encouraged by the World Health Organization (WHO) together with the International Society for Prosthetics and Orthotics (ISPO), and USAID for developing and underdeveloped countries.[34]

Research focused on testing the durability of PETR soda bottles as used in upper extremity prostheses.[35] Results suggest that PETR bottles that are reheated and remolded for a transradial prosthetic socket can withstand an axial load not more than 4 kg, implying that the socket can only be used for simple, light-duty activities such as feeding and self-care.[35] However, standard lower extremity prosthetic components are typically expected to withstand 70 to 100 kg of body weight. According to the statistics on amputees of the Philippine School of Prosthetics and Orthotics (PSPO), lower limb amputee cases outnumbered the upper limb amputee cases in 2016.[36] A study by Jivacate, as cited by Emmons, had lower limb prostheses made from milk bottles for human and elephant subjects with lower limb amputations.[37] Literature did not explicitly mention whether the sockets, componentry, or feet fabricated was made out of recycled plastics. Furthermore, it was unclear if the recycled prostheses were at par with prostheses made from unrecycled materials due to the absence of material property testing and comparison.

Material's Property Testing. One of the characteristics needed for fabricating a prosthetic socket is Vicat softening point because this helps determine the appropriate processing temperature of thermoplastic sheets prior to vacuum forming into a positive mold of a patient's residual limb.[38-43] Gerschutz investigated the ultimate strength of various prosthetic socket materials currently available in the market on prosthetic component adapters using the ISO standard 10328, the highest form of reference available for prosthetic material standards which simulates the forces of gait.[8] The researchers, however, could not determine whether preliminary material properties contributed to socket material pass or failure of ISO 10328 testing since the study was limited to standard procedure testing of only the distal end of the socket material, and not the socket as a whole.[8] Gerschutz later determined that tensile strength and impact resistance was paramount in verifying material safety prior to application on a patient with an amputation.[20] In the absence of standardized procedures for prosthetic sockets, results of the study suggest that tensile strength of around 54 MPa and impact resistance of at least 85 J/m, should be referenced for future researches which determine the quality and safety of prosthetic thermoplastic materials.

Therefore, the aim of the study is to determine if the structural integrity and processing temperature of PETR and PER is comparable to that of PETG.

Methods

A quasi-experimental research design was utilized to fulfill objectives of this study. A range of five to ten samples was prepared from each material (PETR, PER, and PETG) per property of interest based on American Society for Testing and Materials (ASTM)

standards and those required by the Department of Science and Technology Industrial Technology Development Institute (DOST-ITDI) Standards Testing Division.[8,16,17] Three materials were tested in this study --- PETR, PER and PETG, with PETG serving as the standard. PETR was made from two components namely: a large portion of recycled plastic bottle flakes and a small percentage of additives.[44] PER, on the other hand was plainly repurposed from its clear sando bag state. PETR and PER were constructed through two-roll-mill mixing and compression molding. All sample groups were fabricated according to specified ASTM dimensions of each of the three property tests.

Vicat softening point. Vicat softening point was tested according to ASTM D1525: standard test method for Vicat softening temperature of plastics.[13] Resultant values are approximately between 80°C to 160°C, where values close to the lower margin of the acceptable range is favored.[9,16] For this measurement, a Heat Deflection-Vicat Softening Temperature (HDT) tester was used. At room temperature of 23 ± 2°C, the specimen was immersed in a silicon oil bath for uniform heating. A needle was applied on the sample with a load of 10 ± 1.0 newtons (N) until penetration into the specimen, while temperature was initially set at 23°C and gradually increased at a rate of 50°C per hour. The temperature upon needle penetration was recorded as Vicat softening temperature, measured in degrees centigrade.

Tensile strength. Tensile strength was tested according to ASTM D638: standard test method for tensile properties of plastics using a universal testing machine with test fixtures for tensile strength testing.[16] Resultant values are approximately 54 MPa, where the higher the value the better.[5,10] Parallel to its long axis, the two ends of the specimen were mounted between the grips of the machine and were pulled away from each other. Measurements, in units of megapascals (MPa) were taken once the material started to stretch, and when the material broke into two.

Impact resistance. Izod impact testing was performed according to ASTM D256: standard test methods for determining the Izod pendulum impact resistance of plastics.[17] Resultant values are approximately at 85 J/m, where the higher the value the better.[8] A pendulum impact tester was used for this measurement. Measurements were taken at room temperature 23 ± 2°C. The sample, with a notch cut angled at approximately 45°, was clamped vertically onto the vise with the notch facing away from the pendulum. The hammer was released onto the sample and data was recorded, in units of joules per meter (J/m), once the material broke in two from the force exerted by the pendulum hammer.

This study involved PETG, PETR and PER's data on Vicat softening, tensile strength and impact resistance. Data gathered in raw and average form were emailed to the researchers after testing. For the Impact resistance test, Kruskal-Wallis test with post-hoc analysis using Mann-Whitney U test, was used for the differences between values of PETR, PER, and PETG samples. Significance level was set at $p = 0.05$. Kruskal-Wallis and Mann-Whitney U test results were computed by hand and using MS Excel 2017. For tensile strength and Vicat softening point, a descriptive analysis was used to compare the results of PETR and PER with PETG.

Results

As shown in Figure 1, the standard material PETG had a Vicat softening point of 75°C. Between the two alternative materials, sando bag (PER) surpassed the Vicat softening point of PETG at 126°C, while plastic bottle (PETR) was at 0°C. Figure 2 shows that PETG had a mean tensile strength of 56 MPa. Both plastic bottles (PETR) and sando bag (PER) had lower tensile strength at 0 and 25.2 MPa, respectively. As seen in Figure 3 PETG's impact resistance was measured at 71 J/m. Sando bag (PER) had higher impact resistance at 235 J/m; the difference with PETG was significant. Plastic bottles (PETR), had a lower impact resistance at 20.3 J/m.

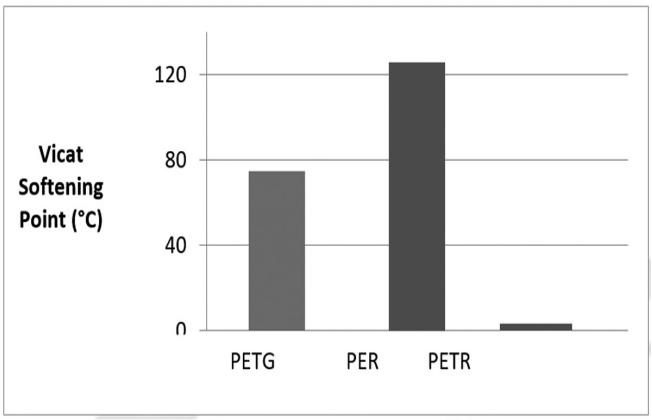

Figure 1. Mean Vicat softening point of PETG, PER, and PETR

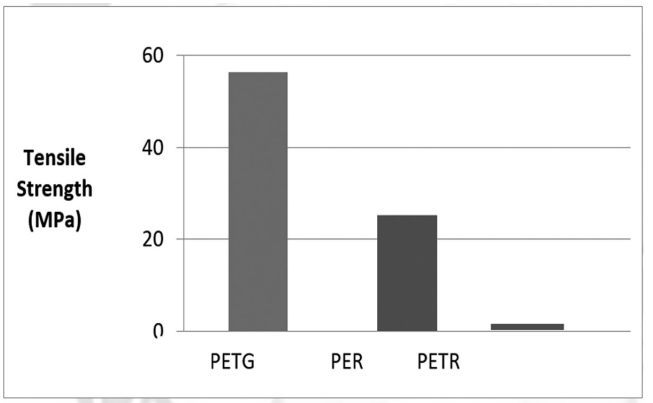

Figure 2. Mean tensile strength of PETG, PER, and PETR

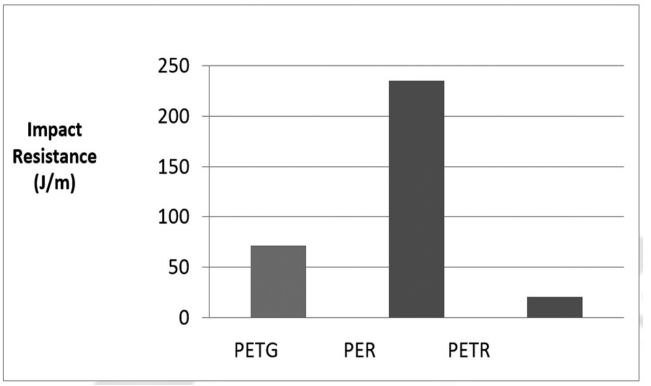

Figure 3. Mean impact resistance of PETG, PER, and PETR

Discussion

The standard material displayed similar tensile strength results with other published works. The studies of Gerschutz and Curbell Plastics showed that PETG's tensile strength is approximately around 54 MPa.[8,45] However, the standard material exhibited noticeable differences with literature in terms of impact resistance and Vicat softening point. Impact resistance of PETG showed lower results (71 J/m) compared to the standard value of 85 J/m.[8] For Vicat softening point, only PETG met the reference standard of 80-160° according to the data sheet from North Sea Plastics.[18] This may be because testing procedures differed from that of North Sea Plastics, since temperature for the study's PETG was recorded when the surface of the material began to soften secondary to heat applied by the silicon oil bath as per ASTM standard D1525, whereas temperature for North Sea Plastics® PETG was taken once the entire material started to soften and became processable.[8,9] The first alternative material PETR performed poorly in all three materials tests done, indicating that PETR was not at par with the standard material, PETG, in terms of Vicat softening point, tensile strength and impact resistance. Results show that PETR possesses a lower Vicat softening point (0˚C) compared to PETG (75˚C). Since PETR's Vicat softening point could not be recorded, temperature setting of ovens prior to vacuum forming for fabricating check sockets could not be determined. Tensile strength and impact resistance also displayed a lower value compared to PETG, where PETR scored 0 MPa and 20.3 J/m while PETG scored 56 MPa and 71 J/m for tensile strength and impact resistance, respectively. Resulting material properties of PETR also displayed no similarities to reviewed articles, as their results showed a range of 2-7 kJ/m^2 for impact resistance, around 50-60 MPa for tensile strength, and 83˚C for Vicat softening point.[46-48]

The possible reasons for the poor performance of PETR could have included 1) the different fabrication method, 2) the plasticizer, and 3) the plastic recycling generation. Differences with the fabrication method of samples were noted as PETR was fabricated through two roll mill and compression molding machine while plastic extrusion and injection molding process were used in the literature.[46,47] The extrusion method and injection molding process make the plastic more ductile and impact resistant. Compression molding, on the other hand, increases the plastic's rigidity and brittleness.[49] Likewise, only pure recycled plastic bottles were used whereas a plasticizer was added to PETR which produced no effect on the sample as it may have evaporated prior to melting of recycled plastic bottle flakes during fabrication.[46,47]

Plastic recycling generation was not taken into account when provided with the raw recycled plastic bottle flakes. This may have been another contributing factor to PETR's poor mechanical and thermal performance since its recycling generation was not consistent throughout the entire structure of the sample. Comparing third, fourth, and later generation plastics to second generation plastics, performance is best in favor of the latter in terms of mechanical properties.[50] Moreover, lower results for Vicat softening point, indicate that PETR does not have the ability to be moldable to any shape.

The second alternative material PER performed well in terms of Vicat softening point (126°C) as it surpassed the standard (75°C). The Vicat softening point of PER is similar to NorthPlex plastics' molding temperature which then implies that PER has the ability to be easily molded when adjusting the material in different forms.[18] The tensile strength of PER (25.2 MPa) was lower compared to the standard (56 MPa), as this was also recorded at yield. This indicates that the sample deformed earlier than expected before splitting apart. Although PER is weaker compared to PETG, it is still comparable to another check socket material, thermolyn rigid.[8]

Fabrication method and reinforcement procedures may also influence the mechanical properties of PER especially in terms of tensile strength. In another study, a twin-screw extruder and an injection molding machine were used to manufacture a sheet of plastic. Reinforcement with polyacrylonitrile (PAN) fiber was added to the mixture in different percentages to improve the properties which resulted to a higher tensile strength and Vicat softening point.[51] This signifies that PER as a socket may possibly deform if patient puts weight but will not break easily. Lastly, the impact resistance of PER performed well (235 J/m) compared to the standard (71 J/m). The value of impact resistance is comparable to the results of copolymer prosthetic sockets (211 J/m) from the study of Gerschutz.[8] Zhu, on the other hand, stated that the values of PER for impact resistance performed closely to that of recycled pure HDPE.[52] The result was expected due to PER's inherent ductility which allowed the material to absorb increasing amounts of force.[5] In another study where PAN fibers were added, the impact resistance property of the sample was compromised due to the brittle nature of PAN fibers and because of the improved crystallinity which decreased the impact strength of the material faster.[51]

Since contracted plastic manufacturers and raw material providers sell by the ton, the study was limited to 3 kg of PETR flakes which contained unsegregated and unaccounted for plastic generation. The amount of raw material available limited the number of trials in determining the best plastic to additive ratio for a good sheet output despite the plastic generation. Furthermore, equipment for processing samples into sheets were also limited to using the two-roll mill and compression molding, where samples fabricated from this technique tended to be more rigid and brittle as evidenced by results of PETR.[46] This technique, however, inversely affected PER in terms of its Vicat softening point and impact resistance.

Even though transparency is enumerated as another important property of a prosthetic check socket, testing it was not performed due to the lack of locally-available testing apparatus despite extensive search, while ISO 10328, the highest form of standardized testing for PO materials, was not performed due to the lack of recommended vacuum forming techniques for processing PETR and PER into a prosthetic socket.[38,20]

The researchers therefore recommend that PETR be processed into sheets through an extrusion or injection molding process and be polymerized with a different plasticizer or reinforcement. Likewise, the three mechanical properties should be tested again before proceeding to the properties not yet tested. Since PER displayed potential to become an alternative material for prosthetic check socket fabrication, the researchers recommend changes to improve the tensile strength property through the addition of reinforcements without affecting Vicat softening and impact resistance. Furthermore, tensile strength testing should be reperformed together with the properties not yet tested. Additionally, the researchers would like to further recommend testing of PER for structural testing of ISO 10328 to determine its integrity with distal prosthetic componentry attached, biological hazards to determine reactions of skin when in long-term contact with the plastic, and to explore the use of PER as a definitive prosthetic socket. Since budget exceeded the allocated amount for funding the study, where one ton of PETR flakes: and fabrication of bigger sheets cost PHP 11,000.00, an extensive prospective review of the cost of manufacturing recycled plastics on a large scale should be considered.

The aim of this study was to produce an alternative material made of recycled plastics with properties comparable with PETG. These mechanical properties include Vicat softening point, tensile strength and impact resistance. PETR performed poorly against PETG in all three tests. This may have been due to several factors which include fabrication method, plastic sample generation, and ineffectiveness of plasticizer. The investigators therefore conclude that PETR, in its current state, cannot to be used as a check socket due to its brittleness and weak thermal properties. PER displayed lower tensile strength compared to PETG but performed better in the Vicat

softening point and impact resistance tests. PER may be a viable prosthetic check socket alternative because of its high impact strength and thermoformability provided that the tensile strength is increased without affecting the Vicat softening point and impact resistance.

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Prevalence of depression among medical students in a private medical school: A cross-sectional study

Paulina Nicole G. Vitocruz; Ann Pauline G. Vivar, RN; Georgene Danielle R. Whang; Namfon M. Wonglue, RMT; Ynh-Chun Wu, RMT; Larimel Jean P. Yadao; Ann Melody Y. Yao; Jacob C. Ybanez; Adrian B. Yu, RPh.; Jose Luisito A. Zulueta, MD;[1] Jose Ronilo G. Juangco, MD, MPH;[1] and Maria Paz S. Garcia, MD[2]

Abstract

Introduction Medical students are susceptible to depression due to the constant exposure to stressful situations and almost 30% of medical students suffer from depression. This study aimed to determine the prevalence of depression among first- to third-year medical students in a private medical institution.
Methods A descriptive, cross-sectional study design was employed on first- to third-year medical students selected through simple random sampling. They were asked to answer the Patient Health Questionnaire-9 for the assessment of depression.
Results The prevalence of moderate to severe depression was 19.1%. Almost 15% of the first-year medical students, 23.7% of the second-year medical students and 18.3% of the third-year students were found to have a risk of having depression. Twenty-one percent of the male students and 18.4% of the females were classified to have depression.
Conclusion Almost one-fifth of the first- to third-year medical students in the private medical institution have depression. The highest prevalence of having depression was among second-year medical students, males, 20 to 22 years old.

Keywords: Depression, medical student, patient health questionnaire

According to the World Health Organization (WHO), mental health and well-being are essential elements of human thought, emotion and interaction, both collectively and individually.[1] Depression is one of the many global health problems which reflects the mental health of the population. Depression is a common illness worldwide, with more than 300 million people affected, and one of the main causes of disability.[2] More women are affected than men.[2]

According to the American Medical Students Association, almost 30% of medical students suffer from depression or symptoms of depression and one out of 10 medical students reported experiencing suicidal thoughts. Medical students, as compared to the general population, are five times more susceptible to being depressed.[3] There have been few studies on the prevalence of depression among medical students in the Philippines.

Correspondence:
Jose Ronilo G. Juangco, M.D., M.P.H., Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center Inc., 64 Aurora Boulevard, Barangay Doña Imelda, Quezon City, PH 1113; e-mail: jgjuangco@uerm.edu.ph

[1] Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc.
[2] Department of Pharmacology, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc.

This study aimed to determine the prevalence of depression among medical students in a private medical institution in the Philippines. Specifically, the researchers sought to determine the extent of depression in terms of age, sex and year level.

Methods

The study employed a descriptive cross-sectional study design. Medical students from a private university in Metro Manila were asked to answer the Patient Health Questionnaire-9. The study was approved by the Ethics Review Committee of the institution.

The target population of the study consisted of 1,325 first- to third year medical students currently enrolled at a private medical institution. From the target population, a minimum sample size of 472 was computed using the population proportion sampling formula, utilizing the results obtained from a cross-sectional study on depression and suicidal ideation in medical students in China.[4] Simple random sampling was used to select the students for each year level using the online Research Randomizer, www.randomizer.org. Those who agreed to join and gave their informed consent were included in the study.

The Patient Health Questionnaire-9 (PHQ-9) was used to measure depression for the study. The PHQ-9 has become the gold standard measurement tool for depression, which helps clinicians in making a criterion-based diagnosis.[5] It is a nine-item self-administered questionnaire consisting of four-point Likert-type closed-ended questions regarding frequency of symptoms of depression patterned after the Diagnostic and Statistical Manual V and ICD-10 diagnostic criteria.[6] A cut off score of ≥ 10 (specificity 95%, sensitivity 77%) indicates presence of depression.[7] Each item can be scored 0 to 3, with 0 = not at all; 1 = several days; 2 = more than half the days; and 3 = nearly every day. The total score can range from 0 to 27, with 0 labeled as no depression; 1 to 4 as minimal depression; 5 to 9 as mild depression; 10 to 14 as moderate depression; 15 to 19 as moderately severe depression; and 20 to 27 as severe depression.

The researchers talked to each prospective participant individually and explained the informed consent form. A hard copy of the questionnaire was given to those who gave their informed consent. The researchers then explained what the questionnaire entailed. Ample time was given to the participants for them to read through and answer the questionnaire on their own. The researchers answered any questions from the participants.

The accomplished questionnaire was checked for completeness of the answers; forms that were incomplete were not included in the data analysis. Data were encoded and tabulated using Microsoft Excel. Quantitative classification of data as either with the absence or presence of depression as well as the classification of its severity were done through the PHQ-9 score classification. The data were analyzed using SPSS version 16.

The study was implemented in accordance with the protocol and ethical guidelines set by the Ethics Review Committee. The researchers ensured that proper ethical principles were observed in, while and after conducting the study. Free and informed consent was obtained from each of the respondents. The identity of the participants was kept private and confidential. Participants who were screened to have depression were referred to the mental health unit of the university for further evaluation and management upon their consent.

Results

From the target randomly selected sample of 519 respondents, 423 (81%) medical students completed the PHQ-9 questionnaire, while the 53 refused to give their consent, 37 were absent during the time of distribution and 6 of them left more than three questions unanswered. The baseline characteristics of 423 participants are shown in Table 1. The mean age of the respondents was 23 years and there were more females (66%) than males. The 20 to 22-year-old respondents (56%) and second-year medical students (37%) comprised the biggest groups.

Among the 423 participants, 19.1% were found to suffer from moderate to severe depression based on the PHQ-9 as seen in Table 1. Among the different levels, the second-year medical students were found to have the highest prevalence of depression (23.7%) as shown in Table 2. Depression was found in one of two students in the age group 19 years old and below, and in one of five students in the other age groups, as seen in Table 3. More female medical students had depression (278 vs 30), but the proportion was higher in the males (20.7 vs 18.4%) as shown in Table 4.

Table 1. Demographic characteristics of the participants (n = 423)

Characteristics	n (%)
Sex	
Male	145 (34.3)
Female	278 (65.7)
Age (yr)	
≤ 19	2 (0.5)
20-22	236 (55.8)
≥ 23	185 (43.7)
Year level	
1st	136 (32.1)
2nd	156 (36.9)
3rd	131 (31.0)
Overall prevalence	
None	31 (7.3)
Minimal	171 (40.4)
Mild	140 (33.1)
With depression	81 (19.1)
Moderate	62 (14.6)
Moderately severe	13 (3.1)
Severe	6 (1.4)

Discussion

Almost similar to the previous studies, prevalence of various levels of depression was highest among sophomore medical students and lowest among the juniors, different from the trend in some of the previous studies that had seen freshmen students with the highest prevalence, followed by the second year and then the third year medical students.[8,9] The results suggest that adopting to the stressful environment with each succeeding year may be a factor for the lower prevalence among the third-year medical students.[10]

Measuring moderate to severe prevalence of depression by year level does not reveal an increasing or decreasing trend in the prevalence per year. In the study by Puthran, the meta-analysis of depression studies in medical students showed a decreasing trend of depression in the higher year levels.[10] Inam found that the prevalence of depression is significantly higher in first- and second-year students compared to the upperclassmen, findings supported by results of the present study.[9] In Vankar's study, mild to severe depression also showed a decreasing trend in the cases of depression as one went through medical school.[8] Differences in results could possibly be multi-factorial. Cuttilan found that depression could be attributed

Table 2. Prevalence of depression by year level

Year level\ Frequency (%)	None	Minimal	Mild	With depression			Total with depression	Total per year level
				Moderate	Moderately severe	Severe		
1st	6 (4.4)	62 (45.6)	48 (35.3)	18 (13.2)	2 (1.5)	0 (0.0)	20 (14.7)	136
2nd	12 (7.7)	66 (42.3)	41 (26.3)	24 (15.4)	9 (5.8)	4 (2.6)	37 (23.7)	156
3rd	13 (9.9)	43 (32.8)	51 (38.9)	20 (15.3)	2 (1.5)	2 (1.5)	24 (18.3)	131
Total	31	171	140	62	13	6	81 (19.1)	423

Table 3. Prevalence of depression according to age range

Age rage Frequency (%)	None	Minimal	Mild	With depression			Total	Total
				Moderate	Moderately severe	Severe		
≤ 19	0 (0.0)	0 (0.0)	1 (50.0)	1 (50.0)	0 (0.0)	0 (0.0)	1 (50.0)	2
20-22	14 (6.1)	93 (40.3)	79 (34.2)	34 (14.7)	7 (3.0)	4 (1.7)	45 (19.5)	231
≥ 23	17 (9.2)	74 (40.0)	59 (31.9)	27 (14.6)	6 (3.2)	2 (1.1)	35 (18.9)	185
Total	31	171	140	62	13	6	81 (19.14%)	423

Table 4. Prevalence of depression among male and female students

Sex/ Frequency (%)	None	Minimal	Mild	With depression Moderate	Moderately severe	Severe	Total	Total
Male	16 (11.0)	49 (33.8)	50 (34.5)	24 (16.5)	2 (1.4)	4 (2.8)	30 (20.7)	145
Female	15 (5.4)	122 (43.9)	90 (32.4)	38 (13.7)	11 (4.0)	2 (0.7)	51 (18.4)	278
Total	31	171	140	62	13	6	81 (19.1)	423

to both social and cultural reasons.[11] Some studies were cited as having a low pooled prevalence from underreporting due to mental health issues being seen in a negative light. Another reason for the reported low prevalence is the understanding of medical students in psychiatry. Another factor is the support system provided by the medical schools.[11] The difference in the prevalence of depression per year level could be attributed to a difference in culture compared to other countries or studies. However, this cannot be supported by current findings.

In a cross-sectional survey among 279 medical students in Wah Medical College, depression was present in 35.1% of students.[12] Sex, examination criteria dissatisfaction, overburden of test schedule, and age were found to be associated with depression. Results of this study showed that most medical students with possible moderate, moderately severe, and severe depression were 20-22 years old. These results were similar with the study done among medical students in Karachi.[13] That study showed that most depressed medical students were 20 to 22 years old. Another study by Wahed and Hassan showed a similar age distribution pattern.[14] An Indian study showed that depression was comparatively more prevalent among younger medical students (aged 17-18 year) The results indicate that higher depression rates are seen among older medical students.[15]

Current findings show that males had a higher prevalence of depression as compared to females, similar to the results of Karaoglu.[16] Conversely, majority of the other studies showed higher prevalence of depression among female medical students than their male counterparts. According to Amr, the proportion of women entering medical school has been increasing worldwide, thus sex is one of the significant factors in a medical student's well-being.[17] The trend that females experience more anxiety and depression than males may suggest that female medical students are more competitive and concerned about their performance especially in securing higher marks in exams.[9,18] Hope and Henderson found that academic underachievement combined with low satisfaction with life is a predictor of symptoms of depression among female medical students.[19]

In line with this, the effects of one's sex on a medical student's anxiety and self-confidence are particularly consistent.[20] A study found that despite female medical students' performance being comparable with their male counterparts, female medical students were noted to consistently report more stress and anxiety and have less confidence in their own abilities. These behaviors can have a significant and often detrimental impact on both internal and external perceptions of ability and can undermine ability and performance which greatly affect satisfaction and sense of achievement among female medical students.

In general, literature shows that female medical students tend to underestimate their abilities, while males tend to overestimate theirs.[21-23] Furthermore, Blanch stated that female medical students may just be more open and willing to admit their feelings of anxiety, stress and lack of confidence in their abilities while male medical students are more reticent to admit these negative feelings.[20] Several other reasons that could explain the higher prevalence rates of depression and anxiety in women compared to men includes greater social freedom for expression of feelings, greater exposure to situations of risk for depression, and physiological and hormonal factors.[24,25]

Almost one-fifth of the first- to third-year medical students in the private medical institution have depression. Among those with depression, the most prevalent was moderate depression, followed by

moderately severe depression. The highest prevalence of depression was among second-year medical students, in males 20 to 22 years old.

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Angelica keiskei (ashitaba) as adjuvant therapy in the maintenance of blood glucose levels among patients with type II diabetes mellitus

Hannah Trisha C. Fuentebella, Ciela Kadeshka A. Fuentes, Pamela Anne M. Gaerlan, Gladys Ericka D. Galang, Rizza Anne Joy P. Galapon, Jouella Camille Q. Mercado, Marra Yoshabel B. Mien, Ma. Allana June C. Miña, Celine Danielle L. Miral, Hannah Faith R. Mojica, Kryle Marxel E. Molina, Rose Ann G. Moncatar and Jose Ronilo G. Juangco, MD, MPH[1]

Abstract

Introduction This study aimed to determine if using *Angelica keiskei* (ashitaba) tablets as adjuvant therapy to the usual medications for patients with type II diabetes mellitus would result in significant lowering of blood sugar.

Methods The antidiabetic effect of *Angelica keiskei* was evaluated in diabetic Filipino patients as an adjuvant treatment to antidiabetic medications through a randomized single-blind placebo-controlled clinical trial. Patients recruited from select barangays in Quezon City and San Juan City were randomly assigned to either ashitaba or placebo group. The effect was measured by obtaining and comparing fasting blood sugar pre- and post-treatment.

Results There was no significant change in FBS from the baseline in the ashitaba ($p = 0.174$) and placebo ($p = 0.128$) groups after two weeks. There was a significant increase in the systolic BP of the ashitaba group ($p= 0.014$) but not in the placebo group. There were no significant changes in the diastolic BP of either group.

Conclusion Dietary supplementation of 500 mg ashitaba capsules thrice daily for two weeks did not exhibit any glucose-lowering effects among type II diabetic patients maintained on oral anti-diabetic medications.

Keywords: Ashitaba, pharmaceutic adjuvant, diabetes mellitus type II, blood glucose

Correspondence:
Jose Ronilo G. Juangco, MD, MPH, Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc., 64 Aurora Boulevard, Barangay Doña Imelda, Quezon City, PH 1113; e-mail: jgjuangco@uerm.edu.ph

[1] Department of Preventive and Community Medicine, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc.

Diabetes remains a healthcare problem worldwide resulting in increasing numbers of newly diagnosed patients per year and deaths throughout the globe. According to the World Health Organization (WHO), between 2000 and 2030, the number of individuals diagnosed with diabetes will increase up to 114% globally as a consequence of urbanization and population aging.[1] Presently, the prevalence of type II diabetes is rapidly increasing in Asian countries and is becoming a major site of a diabetes epidemic

particularly in the Philippines. The country ranked 15th out of 21 countries under the International Diabetes Foundation (IDF) for diabetes prevalence.[2] Statistics showed a prevalence of 5.5% among men and 6.1% in women in 2016, and it was the 6th most common cause of death among Filipinos in 2013.[3,4] Ashitaba (*Angelica keiskei*), a Japanese herb, is known to possess many biological activities. Its medicinal use has been centered on the prevention of diabetes and its associated complications. Its bioactive components, which include chalcones, coumarins and flavanone, have cytotoxic, antidiabetic, antioxidative, anti-inflammatory, antihypertensive, and antimicrobial properties.[5] Two major chalcones from ashitaba have an insulin-like behavior, which ameliorated hyperglycemia in mice.[6] Another study also noted that long-term ingestion of ashitaba juice reduced HbA1c levels in mice with borderline and mild hyperglycemia.[7] A study also discovered that *A. keiskei* chalcones increased the expression of insulin receptors in liver cells as well as in erythrocytes while decreasing the fasting blood glucose in diabetic mice.[7] While studies have supported the effects of *A. keiskei* in vivo as anti-diabetic medicine, clinical testing is required to confirm its efficacy as an antidiabetic in humans. Only few human studies were conducted regarding ashitaba's effectiveness in lowering blood glucose levels.

In this study, the researchers determined the effect of ashitaba as an adjuvant to regular diabetes maintenance medications among type II diabetic Filipino patients. This study also tried to identify adverse events reported by the participants up to 8 to 10 weeks post-treatment.

Methods

A randomized single-blind placebo-controlled clinical trial was carried out to determine the effect of ashitaba, compared with placebo, as an adjunct in the maintenance of blood glucose levels among Filipino patients with type II diabetes. Patients recruited from selected barangays in Quezon City and San Juan were randomly assigned to receive ashitaba or placebo capsules for two weeks. Fasting blood sugar levels were compared within and between groups. The study was approved and conducted in compliance with the PHREB 2017 National Ethical Guidelines for Health and Health-Related Research and was approved for implementation by the UERMMMCI Research Institute for Health Science Ethics Review Committee.[8]

Patients were recruited from selected barangays in Quezon City and San Juan City. Informed consent was obtained from those who fulfilled the following inclusion criteria (based on the history) and agreed to join the study: adult Filipino males or females aged 18 to 59 years, fasting blood glucose ≥ 110 mg/dL, previously diagnosed with type II diabetes mellitus, and taking one or two oral antidiabetic agents as maintenance. Those with any of the following based on the history were excluded: hypersensitivity to any of the active phytochemical substances contained in *A. keiskei* determined through thorough history taking; maintenance with sulfonylureas and/or insulin; severe diseases, complications and comorbidities such as but not limited to cancer, tuberculosis and anemia; current intake of medications for the previously mentioned diseases; possible liver and/or kidney problems; recurrent/severe infections; intake of other herbal supplements; pregnancy or breastfeeding; and alcohol or drug abuse. The minimum sample size was calculated at four per group based on the pilot study conducted to determine the efficacy and safety of ashitaba on patients with metabolic syndrome.[9] The sample size was calculated, wherein the level of significance was set at $p = 0.05$, power of 80%, the standard deviation of 4.9 and a difference to be detected of 10.

Participants were randomly assigned to either ashitaba or placebo group through block randomization. Both simple random sampling and block randomization were computer-generated using Research Randomizer (www.randomizer.org). The participants were asked to attend two sessions. During the first session, the participants' fasting blood sugar (FBS) levels were measured as a baseline laboratory evaluation at the UERM Hospital, as well as their demographic and baseline data. Participants in the experimental group received 500 mg ashitaba capsules while participants in the control group received 500 mg starch capsules as placebo. Both treatments provided were placed in sealed, opaque bottles when handed out to the patients. The participants were instructed to take three capsules, with meals, per day for two consecutive weeks.

The participants were reminded daily through SMS to take both their maintenance and treatment medications. A monitoring sheet was provided per patient to track their compliance. Adverse effects were monitored to a period eight to ten weeks after the

completion of the study. In the second session after the two-week intake of the assigned intervention, the participants were asked to have their fasting blood sugar levels measured for evaluation. During the study, the participants were advised not to switch to different anti-hyperglycemic agents nor to take other herbal medications.

Data were gathered and analyzed per protocol and with intention to treat. The investigators determined the change in blood sugar level at the end of the second week as the primary outcome. Statistical analysis of the data was conducted using IBM SPSS Version 20. Each parameter was expressed as a mean ± standard deviation. A paired t-test was used to determine if there was a statistically significant difference in the changes of means of the measured FBS and BP, pre- and post-intervention among the ashitaba and placebo groups. An independent t-test was also used to analyze the significant difference between groups. $P < 0.05$ was considered to be significant for both tests. Fisher's exact test for the nominal variables, and an independent t-test for numerical variables, were used to determine the comparability of the ashitaba and placebo groups.

Results

Table 1 shows that there were more men in the ashitaba group, that those in the ashitaba group were younger, had a higher BMI, larger waist circumference, and weighed more. The differences in BMI ($p = 0.005$), waist circumference ($p = 0.019$), and weight ($p = 0.029$) were significant. There was no significant change in FBS from the baseline in the ashitaba ($p = 0.174$) and placebo ($p = 0.128$) groups after two weeks, as seen in Table 2.

The adverse effects were monitored as reported by the patients and are shown in Table 3. There was a significant increase in the systolic BP of the ashitaba group ($p= 0.014$) but not in the placebo group. There were no significant changes in the diastolic BP of either group. For every 10 patients given ashitaba at 500 mg thrice daily, two patients would develop elevations of their systolic BP (number needed to harm).

Discussion

The efficacy of ashitaba, a traditional Japanese herb, was evaluated as an adjunct to standard therapy in patients with type II diabetes mellitus. Based on the results of the study, the ingestion of 500 mg ashitaba capsules thrice daily for two weeks did not lead to any significant changes in the FBS levels of the study participants.

The significant differences in BMI, waist circumference and weight may have affected the outcome of the study. The dose of ashitaba given to the study participants and the total duration may have been insufficient to produce significant effects.

Table 1. Baseline characteristics of study participants

Demographics	Ashitaba (n = 5)	Placebo (n = 5)	p-value
Number of males	3	1	0.429
Age (yr ± SD)	44.2 ± 11.30	50.2 ± 7.09	0.344
Body mass index (kg/m^2)	32.8 ± 5.24	21.5 ± 3.94	0.005
Waist circumference (cm)	42.1 ± 5.57	34.0 ± 2.67	0.019
Weight (kg)	79.8 ± 23.82	49.4 ± 9.56	0.029
Height (cm)	157.4 ± 9.10	152.2 ± 5.50	0.306

Table 2. Comparison of fasting blood sugar in ashitaba and placebo groups

	Ashitaba (n = 4)			Placebo (n = 4)		
	Week 0	Week 2	Change	Week 0	Week 2	Change
FBS (mmol/L)	12.6 ± 5.14	13.0 ± 5.27	-0.42 ±0.56	11.8 ±4.01	10.7 ± 3.38	1.16 ±1.09

Note: All values are shown as mean ± standard deviation
*Significant at $p < 0.05$ (paired t-test)

Table 3. Comparison of blood pressure in ashitaba and placebo groups

Blood pressure (mm Hg)	Ashitaba (n = 4)			Placebo (n = 4)		
	Week 0	Week 2	Change	Week 0	Week 2	Change
Systolic	127.5 ± 18.93	142.5 ± 17.08	-15.0 ± 5.77 *	134.0 ± 27.93	128.0 ± 8.37	6.0 ± 27.02
Diastolic	87.5 ± 9.57	100.0 ± 11.55	-12.5 ± 12.58	88.0 ± 8.37	92.0 ± 8.37	-4.0 ± 5.48

Note: All values are shown as mean ± standard deviation
*Significant at $p < 0.05$ (paired t-test)

The pilot study conducted by Ohnogi used a daily dose of 6.2 g of ashitaba on patients diagnosed with metabolic syndrome, with results being significant after four weeks.[9] However, ashitaba administration was given thrice daily since a study recommended that oral administration of ashitaba should be at least three times per day to achieve and maintain its desired plasma levels, due to C16, a bioactive metabolite found in ashitaba.[10]

Numerous studies have been able to prove that ashitaba exerts a significant effect on blood sugar levels. The current study only administered a daily dose of 1.5 g ashitaba for a two-week period as recommended by the pharmaceutical company producing the capsules. It was also done due to limitations on time and resources. Ideally, the study should have been conducted for four weeks based on literature.

There have been studies that investigated the safety of ashitaba as a drug and have concluded that ashitaba was generally safe with little to no adverse effects reported.[11] Ohnogi reported that ashitaba is a safe foodstuff for human consumption, as adverse effects were not observed among patients diagnosed with metabolic syndrome.[9] However, this study noted a significant increase in the systolic blood pressure of the patients in the treatment group, which is in contrast to the purported antihypertensive effects of ashitaba as seen in previous studies. There is a need to investigate this apparent adverse effect in future studies.

There was no significant change in the FBS values within the treatment and control groups during the two-week period. These results suggest that daily administration of 1.5 g ashitaba for two weeks does not exhibit any glucose-lowering effects among type II diabetic patients maintained on oral antidiabetic medications.

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Books and other monographs

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University of the East Ramon Magsaysay Memorial Medical Center
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Telefax (02) 716-1843; Trunk Line (02) 715-0861 loc. 358
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