

Comparison of Social-media-based and Paper-based Educational Tools Aimed at Improving Knowledge of Folate and Neural Tube Defects in Female University Students

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ABSTRACT

Growing internet usage has resulted in increased popularity of web-based tools in nutrition and health education. This research aimed to determine which education delivery medium,

Facebook or leaflet, was most successful at increasing knowledge of folate and neural tube defects (NTD) in female university students. This quasi-experimental study (pre-test post-test comparison group design) involved three groups: Facebook folate and NTD education group (FBed) (n=53), leaflet folate and NTD education group (LFed) (n=49) and comparison group (n=47). Socio-demographic information was collected via a questionnaire at pre-test, and participants completed a folate and NTD knowledge quiz at pre-test and post-test. The Wilcoxon signed rank test was used to determine within-group pre-test post-test differences in folate and NTD knowledge score. Between-group differences in knowledge

were determined using the Kruskal-Wallis test and the Mann-Whitney U test. Pre-test knowledge of folate and NTD did not differ between the three groups ($p=0.408$). Post-test knowledge of folate and NTD in both education groups was greater than in the comparison group, and knowledge score in the LFed group was higher than in the FBed group (all $p<0.001$). Less engagement with the media in the Facebook group could help to explain their lower post-test knowledge scores compared with the leaflet group. Leaflets may be most effective at improving folate and NTD knowledge, and future studies should focus on developing interventions that result in long-term improvements in knowledge and behavioral change.

Keywords: Folate and neural tube defects; female university students; education intervention; social media; improving knowledge

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Introduction

The continued global expansion of internet usage has resulted in an increase in the use of web-based tools, including social media, to provide health-related information¹⁻⁴. Young women are among the prime users of social media. However, more evidence is needed to determine if social media is an effective way of delivering health and nutrition information in comparison with more conventional and traditional mediums. Where reproductive-aged women are concerned, one important health message relates to the role of folate in reproductive health.

Folate, a B-complex vitamin, is the generic term for folates which occur naturally in some foods and the synthetic form, folic acid, which is added to some dietary items and is available as a tableted supplement⁵. Folate plays a well-established role in the prevention of neural tube defects (NTD), which are serious congenital malformations involving the brain or spinal cord⁶. Estimated prevalence rates vary. Average prevalence rates for the European region and the Americas are 0.90 and 1.15 NTD cases per 1,000 births, respectively, while a prevalence of 1.58 NTD cases per 1,000 births has been reported for the south and south-east Asia region⁷. The prevalence of NTD in Thailand is reported to be 0.5 cases per 1,000 live births⁸. NTD incur high emotional and financial

burdens on affected families. Consequently, countries in all regions of the world have implemented programs aimed at educating reproductive-aged females about the benefits of increasing folate intake. Raising awareness about NTD and folate during pregnancy is too late for the prevention of NTD because the peri-conceptional period, and up to four weeks post-conception, is the critical time for increasing folate intake to prevent NTD⁹. Some programs, such as the Thai red cheek campaign that was launched in 2017, are solely aimed at newly-married women aged 20-34 years¹⁰. Other approaches encompass wider outreach and include raising awareness of the importance of folate status among individuals who are not yet contemplating having children, such as student groups^{2, 11-14}.

Past surveys showed that Thai reproductive-aged women had poor knowledge and awareness of folate in relation to NTD. In one of these surveys, as few as 16% of women were aware of the necessity for adequate folate intake¹⁵. In a different survey, only 40% of female medical personnel knew about the importance of folate¹⁶. While increased knowledge of the role of folate does not equate to increased intake, the adoption of a behavior is positively modified by awareness and knowledge. The third UN Sustainable Development Goal is focused on guaranteeing healthy lives and encouraging

well-being across all age groups, but women of reproductive age are at the center of many of the goal's targets¹⁷. Positive nutrition and health messages can empower young women to make healthy dietary choices and ultimately promote future preconception health. Facebook was a popular social media application at the time that this study was conducted. Therefore, our aim was to determine which education delivery medium, Facebook or leaflet, was most successful at increasing folate and NTD knowledge, in a group of female university students.

Materials and Methods

This study used a quasi-experimental research design (pre-test post-test comparison group design), and involved three groups: Facebook folate and NTD education group (FBed), leaflet folate and NTD education group (LFed) and a comparison group. Sample size was calculated using a formula for comparing multiple means, with alpha set at 0.05, beta set at 0.2¹⁸, and data from Jay et al¹⁹. A sample size of 43 per group was obtained, based on the average post- test difference in knowledge between a group receiving education about food label use via a brochure and a group receiving the same information via online media¹⁹. Sample size was increased to 50 per group after adding 15% to account for drop-outs. Faculties of Mahidol University

were purposively chosen based on their numbers of female students and the researchers' access to these faculties. Following receipt of ethical approval from the Ethical Review Committee for Human Research, Faculty of Public Health, Mahidol University (MUPH 2013-164), the FBed group (n=53) was recruited from one faculty, the LFed group (n=49) was recruited from two smaller faculties, and the comparison group (n=47) was recruited from another faculty. Fourth year undergraduate females were recruited from each selected faculty using convenience sampling. Students who were not Facebook users, and who were from the faculty where the Facebook intervention was administered, were excluded from participating in the study. None of the students' undergraduate programs included nutrition courses.

At pre-test, after written informed consent had been obtained, all participants completed a socio-demographic questionnaire and a folate and NTD knowledge quiz. Both documents were self-administered, paper-based, and had been designed specifically for this study. The socio-demographic questionnaire covered questions about factors that might have affected baseline knowledge of folate and NTD, such as place of schooling and parental socio-economic indicators. The folate and NTD knowledge quiz items were first checked for internal consistency (Cronbach's alpha = 0.621). The final quiz consisted of

nine questions, all with multiple-choice answers. An example of a quiz item was: “What are neural tube defects?” (a) among the most common preventable birth defects, (b) structural abnormalities of either the brain or spinal cord, (c) both of the above, (d) don’t know. Following the pre-test quiz, all participants in the FBed group were given access to a Facebook page, while the LFed group was provided with a color-printed paper leaflet. Both educational tools contained the same information about folate and NTD, and were especially designed for this study.

The comparison group did not receive any intervention during the course of the study. At post- test, two weeks later, all participants completed the same folate and NTD knowledge quiz. The duration between pre-test and post-test was two weeks, due to time constraints. After completion of the study, the intervention was sent to all participants in the comparison group, in order to give them an opportunity to access folate and NTD information. Figure 1 shows the outline of the research protocol.

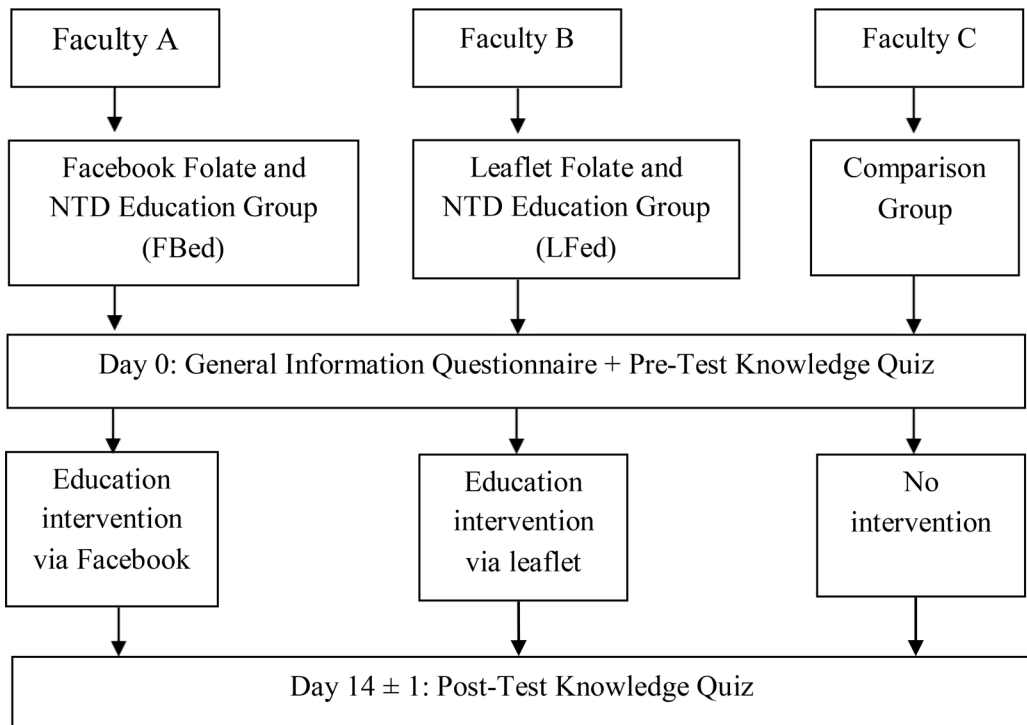


Figure 1 Outline of the research protocol

Data were analyzed using PASW Statistics for Windows, Version 18.0. (Chicago: SPSS Inc.), and statistical significance was set at $p < 0.05$. Age and knowledge score were tested for normality of distribution using the Kolmogorov-Smirnov test. Age was normally distributed, whereas knowledge score did not follow a normal distribution. The one-way ANOVA was used for between-group comparison of age, and Pearson's Chi-Square test was used to examine associations between categorical sociodemographic variables and group. The Wilcoxon signed rank test was used to determine within-group pre-test post-test differences in folate and NTD knowledge score. Between-group differences in folate and NTD knowledge scores were determined using the Kruskal-Wallis test, first at pre-test then at post-test. Following this, the Mann-Whitney U test was used for pairwise comparisons of post-test knowledge scores (FBed vs. LFed groups, FBed vs. comparison groups, and LFed vs. comparison groups), to locate the post-test differences in knowledge score.

Results

All participants completed the study.

There were differences in place of birth and schooling between the three groups (both $p < 0.001$; Table 1); more participants from the FBed group were born and schooled outside of Bangkok and its metropolitan areas compared with participants in the LFed and comparison groups. Other socio-demographic characteristics were similar between the three groups.

Table 2 shows the outcomes of between- and within-group analyses of pre-test and post-test knowledge scores in the FBed, LFed and comparison groups. Pre-test knowledge of folate and NTD did not differ between the three groups ($p = 0.408$). Within-group analysis showed that knowledge score increased from pre-test to post-test in both education groups (both $p < 0.001$). In the comparison group, there was a decrease in knowledge score from pre-test to post-test ($p < 0.05$). As knowledge score differed between the three groups at post-test ($p < 0.001$), a pairwise analysis was then carried out. As shown in Table 3, post-test knowledge of folate and NTD in both education groups was greater than in the comparison group, and knowledge score in the LFed group was higher than in the FBed group (all $p < 0.001$).

Table 1 Sociodemographic characteristics of FBed, LFed and comparison groups

Group	FBed	LFed	Comparison	p
n	53	49	47	
Age, mean (SD)	21.6 (±0.6)	21.6 (±0.7)	21.7 (±0.6)	0.624 ^a
Place of birth, n (%)				<0.001 ^b
Bangkok [†]	12 (22.6)	34 (69.4)	41 (87.2)	
Provinces	41 (77.4)	15 (30.6)	6 (12.8)	
Place of schooling, n (%)				<0.001 ^b
Bangkok [†]	6 (11.3)	31 (63.3)	43 (91.5)	
Provinces	47 (88.7)	18 (36.7)	4 (8.5)	
Mother's education, n (%)				0.244 ^b
Primary	14 (26.4)	8 (16.3)	12 (25.5)	
Lower secondary	2 (3.8)	5 (10.2)	7 (14.9)	
Upper secondary	12 (22.6)	3 (6.1)	7 (14.9)	
Vocational diploma	10 (18.9)	13 (26.5)	7 (14.9)	
Bachelor's degree	14 (26.4)	18 (36.8)	13 (27.7)	
> Bachelor's degree	1 (1.9)	2 (4.1)	1 (2.1)	
Father's education, n (%)				0.922 ^b
Primary	7 (13.2)	7 (14.3)	7 (14.9)	
Lower secondary	6 (11.3)	3 (6.1)	6 (12.8)	
Upper secondary	10 (18.9)	7 (14.3)	10 (21.3)	
Vocational diploma	11 (20.7)	10 (20.4)	7 (14.9)	
Bachelor's degree	16 (30.2)	18 (36.7)	12 (25.5)	
> Bachelor's degree	3 (5.7)	4 (8.2)	5 (10.6)	
Monthly family income, Thai Baht, n (%)				0.503 ^b
<20,000	10 (18.9)	9 (18.4)	5 (10.6)	
20,001-30,000	15 (28.3)	13 (26.5)	13 (27.7)	
30,001-40,000	11 (20.8)	5 (10.2)	11 (23.4)	
40,001-50,000	8 (15.0)	5 (10.2)	5 (10.6)	
>50,000	9 (17.0)	17 (34.7)	13 (27.7)	

FBed, Facebook folate education group; LFed, leaflet folate education group; [†]Includes Bangkok metropolitan areas; ^aOne-way ANOVA; ^bPearson's Chi-square test

Table 2 Pre-test and post-test knowledge scores in FBed, LFed and comparison groups

Score	FBed (n=53)	LFed (n=49)	Comparison (n=47)	<i>p</i> ^a
Pre-test	2 (1, 4)	2 (0, 3.5)	2 (0, 3)	0.408
Post-test	6 (2.5, 9)	8 (8, 8)	1 (0, 2)	<0.001
<i>p</i> ^b	<0.001	<0.001	0.027	

FBed, Facebook folate education group; LFed, leaflet folate education group; Median (25th, 75th percentiles) ^aKruskal-Wallis test; ^bWilcoxon signed rank test

Table 3 Pairwise group comparison of post-test knowledge scores: FBed vs. LFed groups, FBed vs. comparison groups, and LFed vs. comparison groups

Groups	Post-test score	<i>p</i> ^a
FBed vs. LFed	6 (2.5, 9) vs. 8 (8, 8)	<0.001
FBed vs. Comparison	6 (2.5, 9) vs. 1 (0, 2)	<0.001
LFed vs. Comparison	8 (8, 8) vs. 1 (0, 2)	<0.001

FBed, Facebook folate education group; LFed, leaflet folate education group; Median (25th, 75th percentiles) ^aMann-Whitney U test

Discussion

The leaflet medium was more successful than the Facebook medium at improving folate and NTD knowledge score in the university students who participated in this study. This might have been because some participants in the FBed group did not view the Facebook page, whereas the LFed group were personally handed the leaflet and therefore may have been more inclined to read it due to ready access. Similarly, the outcome of a multi-faceted education campaign aimed at women of reproductive age demonstrated that more than twice as many women recalled

folate-related messages from a brochure than from the internet intervention¹. Other researchers have attempted to improve a target group's engagement with online media by shaping messages to suit the interests of the target group. For example, Mackert et al. used Twitter messages which promoted the consumption of multivitamins while emphasizing themes more relevant to university students, such as general health and beauty; however, the desired 'snowballing' of messages did not occur as students did not retweet the messages².

Interactive internet tools may be more successful than non-interactive internet tools

at enhancing learning and therefore improving health-related knowledge. For instance, Reininger et al. reported that the health messages on an interactive educational website positively influenced intention to eat a healthy diet, although it was noted that individuals with low internet literacy scores did not benefit from this approach³. Breastfeeding knowledge, self-efficacy and attitudes improved after parents engaged with an interactive website⁴. Moreover, the social version of an online educational platform, which allowed Facebook friends to view each other's performance, resulted in greater levels of engagement and was more successful than the private version of the platform at increasing nutritional knowledge²⁰. Therefore, if the current study's online education had been interactive, its effectiveness may have equaled or exceeded the paper-based approach.

The level of engagement with online nutrition education has also been found to differ depending on the type of device used to access it (i.e. computer or laptop versus phone or tablet). Individuals who accessed an interactive website via a phone or tablet had the least level of engagement, as they viewed the fewest links and spent the least amount of time using the website²¹. In the current study, the type of device that was used to access the Facebook education intervention was not documented, however,

fewer participants engaging with the media in the Facebook group could help to explain their lower post-test knowledge scores compared with post-test knowledge scores in the leaflet group.

Nevertheless, both education groups scored significantly higher at post-test, compared with the comparison group, which was most likely due to the NTD and folate information provided to them as part of this study. In contrast, knowledge scores decreased from pre-test to post-test in the comparison group. This demonstrates that simple interventions can improve folate and NTD knowledge among female students, at least in the short term. The authors recognize that an increase in knowledge does not equate to positive changes in dietary intake. For example, three half-hour classroom-based lessons followed by the creation of a short podcast increased folate knowledge in high school students, but was not accompanied by an improvement in dietary folate intake¹³. Similarly, Murphy and Dipietro reported that knowledge of folate and NTD among female university students was retained 12 months after a 30-minute presentation, but there was no improvement in regular multivitamin use¹⁴.

This research has several limitations and strengths. Students were recruited from one academic year of one university and, therefore, may not be representative of students in

other age groups or students studying at other institutes. Although purposive sampling was used to select faculties based on the number of female students in those faculties and the ability of the researchers to gain access, care was taken to ensure that the undergraduate programs in those faculties did not include nutrition courses. Indeed, baseline knowledge of folate and NTD in all three groups was similarly low. Due to time constraints, the duration between pre-test and post-test was short (2 weeks). A longer period of time between pre-test and post-test, or a follow-up, could determine whether the knowledge is retained in the long term. It is recognized that having knowledge is often insufficient to promote behavioral changes. However, this study set out to determine which medium is effective in increasing knowledge, and the outcome of this study can be used to plan more extensive programs aimed at improving folate knowledge, awareness and status in women of reproductive age.

In conclusion, information delivered via a traditional paper-based approach and a social media application increased knowledge of folate and NTD among female university students. Baseline knowledge was low but was significantly increased in the short-term following this simple intervention. Traditional media may be most effective in improving folate and NTD knowledge, and future studies should focus on developing interventions that

result in long-term improvements in knowledge and behavioral change. The overall aim of future interventions should be to promote the early adoption of healthy dietary habits during adolescence and early adulthood, in order to establish optimal folate status prior to the reproductive stage of life.

Author contributions

CH, PM, PB and PS designed the study and formulated the content of the intervention tools and knowledge questionnaire. PM, PB and PS designed the intervention tools and knowledge questionnaire, with guidance from CH and WS. PM, PB and PS conducted the study under the supervision of CH. PM, PB and PS carried out reliability testing and the initial statistical analysis of data, following advice from MT. CH re-analyzed the data and wrote the manuscript. WS produced the original Thai translation of the abstract, and PM, PB and PS helped to revise it. All authors read and approved the manuscript prior to submission for publication.

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Conflicts of interest

The authors have no conflicts of interest.

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การเปรียบเทียบของเครื่องมือทางการศึกษาแบบสื่อสังคมและแบบแผ่นพับที่มุ่งเน้น การเพิ่มความรู้เกี่ยวกับไฟเลตและภาวะหลอดเลือดประสาทมปิดในนักศึกษาหญิง

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บทคัดย่อ

การเติบโตของการใช้อินเตอร์เน็ตส่งผลให้ความนิยมของเครื่องมือทางโภชนาการและสุขภาพศึกษาผ่านเว็บเพิ่มขึ้นงานวิจัยนี้มุ่งค้นหาว่าสื่อการศึกษาแบบใด เฟชบุ๊กหรือแผ่นพับ ประสบผลสำเร็จในการเพิ่มความรู้เกี่ยวกับไฟเลตและภาวะหลอดเลือดประสาทมปิดในนักศึกษาหญิง การวิจัยกึ่งทดลองนี้ (แบบกลุ่มเปรียบเทียบวัดผลก่อนและหลังการทดลอง) ประกอบด้วย 3 กลุ่ม: กลุ่มได้รับความรู้เกี่ยวกับไฟเลตและภาวะหลอดเลือดประสาทมปิดผ่านเฟชบุ๊ก (n=53) กลุ่มได้รับความรู้เกี่ยวกับไฟเลตและภาวะหลอดเลือดประสาทมปิดผ่านแผ่นพับ (n=49) และกลุ่มเปรียบเทียบ (n=47) เก็บข้อมูลสังคมประชากรใช้แบบสอบถามที่ก่อนการทดลอง และผู้เข้าร่วมวิจัยทำแบบทดสอบความรู้เกี่ยวกับไฟเลตและภาวะหลอดเลือดประสาทมปิดก่อนและหลังการทดลอง การทดสอบเครื่องหมายลำดับที่ของวิลคอกชันใช้ทดสอบความแตกต่างระหว่างคะแนนความรู้เกี่ยวกับไฟเลตและภาวะหลอดเลือดประสาทมปิดก่อนและหลังการทดลอง ภายในกลุ่มเดียวกัน ความแตกต่างของคะแนนความรู้ระหว่างกลุ่มวิเคราะห์

โดยใช้การทดสอบของครัสคาลและวัลลิส และการทดสอบของแมนน์ วิทนีย์ ยู ความรู้เกี่ยวกับไฟเลตและภาวะหลอดเลือดประสาทมปิดก่อนทดลองไม่แตกต่างระหว่าง 3 กลุ่ม (p=0.408) ความรู้หลังทดลองในกลุ่มได้รับความรู้ทั้ง 2 กลุ่มเพิ่มขึ้นมากกว่ากลุ่มเปรียบเทียบ และคะแนนความรู้ของกลุ่มได้รับความรู้ผ่านแผ่นพับสูงกว่ากลุ่มได้รับความรู้ผ่านเฟชบุ๊ก (all p<0.001) การมีส่วนร่วมที่น้อยกับสื่อในกลุ่มได้รับความรู้ผ่านเฟชบุ๊กช่วยอธิบายคะแนนความรู้หลังทดลองที่ต่ำกว่าเมื่อเปรียบเทียบกับกลุ่มได้รับความรู้ผ่านแผ่นพับ แผ่นพับอาจมีประสิทธิภาพในการเพิ่มความรู้เกี่ยวกับไฟเลตและภาวะหลอดเลือดประสาทมปิด และการศึกษาในอนาคตควรเน้นการพัฒนาโปรแกรมที่ส่งผลกับการสร้างเสริมระยะยาวในความรู้และปรับเปลี่ยนพฤติกรรม

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