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(RESEARCH ARTICLE)

Cardiovascular prevention using WhatsApp, project "Family Health: Connected and Healthy"

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Abstract

Objective: to analyze whether an educational program for cardiovascular prevention using WhatsApp can contribute to reducing Framingham risk score (FRS) among adults.

Method: this is an intervention study, developed during one year (October/2019 to October/2020) in three public schools in São Paulo, among fathers, mothers, and family members of children enrolled in elementary school. Parents were invited to participate in the study by means of a note sent in the school agenda, and after signing the consent form, the participants received a weekly message from the researchers by WhatsApp, with guidelines to avoid sedentarism and maintain healthy lifestyle habits. Clinical and laboratory data were collected at the beginning and end of the study.

Results: the study subjects were 70 adults, age 43.2 (±12 years), 47 females and 23 males. At the beginning of the study there were 09 (12.9%) parents with intermediate or high FRS, and at the end of the study there were 08 (11.4%) parents with intermediate or high FRS (p=0.79). A reduction in diastolic blood pressure was observed, mean from 80.3 mmHg to 77.7 mmHg (p=0.03; ±9.44), other three risk factors showed worsening in the outcome at the end of the study: HDL-cholesterol reduced mean from 55.9 mg/dL to 48.7 mg/dL (p=0.01), blood glucose increased from 91.4 mg/dL to 94.4 mg/dL (p=0.01) and body mass index was from 28.6 to 29.2 (p=0.01).

Conclusion: The cardiovascular prevention education program using WhatsApp did not promote a reduction in FRS, and diastolic blood pressure was the only risk factor that responded to the intervention.

Keywords: Cardiovascular Diseases; Health Education; Social Media; Social Network; Prevention and Control.

1. Introduction

Cardiovascular diseases (CVD) account for approximately one-third of annual deaths, is the leading cause of mortality and one of the greatest health challenges in almost every country in the world [1,2].

The socioeconomic burden related to early mortality, side effects and other losses to society, highlights the need to intensify prevention of CVD, especially when considering the cost-benefit of preventive actions compared to curative

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ones, the scarcity of resources in poorer countries, especially the social damage secondary to morbidity and mortality of people in economically productive age [1-3].

Despite the high mortality, CVD is highly preventable; however, strategies for prevention must be based on the cardiovascular risk factor (RF) profile of each population. For example, while in Brazil hypertension is the main factor for CVD, in the United States the most important risk factor is dyslipidemia [4] .

The relationship between RF and CVD is a constantly evolving process, which requires re-evaluation over time so that prevention strategies are appropriate to changes in population profiles and risk factors [1,4].

Brazil is a country of continental dimensions, with great socioeconomic and cultural differences in the population of its different regions. However, the application of public resources in preventive actions for CVD is scarce throughout the national territory, being necessary to seek more effective strategies and with lower costs so that preventive actions can reach the most vulnerable groups, the populations with lower income [4,5].

The use of information and communication technologies (ICTs), especially messaging applications, seems to be a low-cost strategy that can be developed with a large number of people.

Messages via cell phones have shown positive results with health education interventions; studies evaluating this strategy in health education programs have observed effectiveness in reducing obesity [6], in the control of diabetes [7,8] and smoking cessation [9].

However, two international reviews have observed no efficacy in studies using telephone messaging in primary prevention of CVD. A Cochrane review [10] evaluated four studies totaling 2429 participants and a systematic review [11] involved 3779 participants, the research emphasizes that despite the limitations of the studies some positive results were observed, and points out that new studies are needed to prove its effectiveness and reproducibility in different populations.

In Brazil, there is still no publication on the use of ICTs in programs to assess the reduction of Framingham global risk score (GRS) [12], what the present study proposes. The GRS is the most widely used indicator in the world to assess cardiovascular risk and, therefore, also adopted by the Ministry of Health in the risk stratification for atherosclerotic disease among the Brazilian population [1,13].

Thus, this study aimed to analyze whether an educational program for cardiovascular prevention using WhatsApp can contribute to reducing FRS among adults.

2. Methods

2.1. Study design and casuistry

This is an intervention study, developed during one year, from October 2019 to October 2020, in a city in the metropolitan region of Campinas (MRC), interior of the state of São Paulo, Brazil. The research was conducted in three public schools, with fathers, mothers, and family members of children enrolled in elementary school I (ESI).

Parents were invited to participate in the study after a talk of approximately twenty minutes, held by a researcher, to present the project, which occurred in each school in the first semester meeting of parents and teachers in August 2019. To invite the absent parents and family members at this meeting, a note was sent in the students' school calendar, and those who accepted the invitation scheduled a meeting with the researchers at the school to receive more information and clarifications about the project, and at the end of each meeting, the participants signed the informed consent form, kept one copy of the document, and delivered another to the researcher.

Participants received a weekly WhatsApp message from the researchers, with guidelines to avoid sedentary lifestyles and maintain healthy habits. Clinical and laboratory data were collected at the beginning and at the end of the study.

2.2. Population

The participants of the study were fathers, mothers and family members of children enrolled in classes from 1st to 4th grade of ESI in three public schools in the urban area.

The selection of the schools involved was defined by a draw in a meeting between the researchers and the Municipal Secretariat of Education. The city where the research was developed belongs to the MRC, a region composed of 20 municipalities and over 3.2 million inhabitants.

The municipality has the lowest Human Development Index (HDI) of the MRC, in the last assessment conducted in 2010 by the Brazilian Institute of Geography and Statistics (IBGE), the municipal HDI was 0.762, lower than the average of the state of São Paulo: 0.805. In the assessment of average household income per capita, in the last assessment in 2010, in the municipality this value was R$ 785.45 per capita and in the state of SP it was R$ 1,416.13 [14].

2.3. Inclusion and exclusion criteria

All fathers, mothers, and relatives of children enrolled in classes from 1st to 4th grade in ESI were included in the study, regardless of whether they were biological or adopted children, provided that the participant had a cell phone with the WhatsApp application, knew how to use this application, agreed to receive and view all messages that were sent weekly by the researchers.

Parents and family members who did not perform the second data collection at the end of the study were excluded from the study, as well as those who remained more than six weeks without viewing the WhatsApp messages, in this situation, in the fourth week without viewing messages the researcher made contact with the participant, sent a message asking the reason for not viewing, if after this contact from the researcher there was no viewing of messages in the following two weeks the participant was excluded from the study.

2.4. Data collection

Data collection was conducted by the researchers themselves at two points in time, in September 2019 before starting the intervention, and at the end of the research in October 2020.

Initially, a meeting was held with the principal of each school to present the project and discuss with those responsible how these school professionals would contribute to the study, such as helping in the presentation of the project to parents, opening the school on Saturdays and providing the physical structure of the school on these days of data collection, and helping in contacting the participants when they sought the school with questions or any issue related to the study.

The researchers trained a team of 30 undergraduate nursing students to assist in data collection. All student volunteers received prior training to learn about the data collection instruments, standardize the performance and recording of measurements and examinations performed.

All data collection activities were performed under the supervision of a researcher responsible for the project.

Data collection was performed on Saturdays, one morning in each school, on a date previously scheduled and confirmed through a WhatsApp message, or phone call when necessary, to ensure a 12-hour fast for the blood tests of each participant.

A questionnaire was used to record the subjects' age, sex, health history, and socioeconomic classification, and recording of measurements of blood pressure, abdominal circumference, body mass index, and the serum dosage of total cholesterol and fractions, triglycerides, and blood glucose.

The study began after the project was approved by the Research Ethics Committee of the Campo Limpo Paulista University Center, registered in the *Plataforma Brasil* / National Health Council with opinion no. 4,139,591.

2.5. Assessment of cardiovascular risk factors

To obtain the body mass index (BMI) the weight and height of the participants were evaluated in triplicate, without shoes and wearing light clothes.

For weighing, a digital scale was used, with an accuracy of 100 grams, calibrated the day before data collection. Height was measured using a portable stadiometer, accurate to 1 millimeter. BMI was calculated by dividing the weight (in kilograms) by the square of the height (in meters).

The measurement of abdominal circumference followed the technique recommended by the Brazilian Diabetes Society Guidelines [15], the measurement was performed right after the BMI evaluation, in the same room, a private place that guaranteed the participant's privacy.

Blood pressure (BP) measurement followed the technique recommended by the VII Brazilian Guidelines on Hypertension [16], with a mechanical aneroid sphygmomanometer, calibrated the day before data collection. The BP measurement was performed with the individual seated and with the arm positioned at heart level, the measurement was performed on the right and left arms, and if there was a difference equal to or greater than 10 mmHg between the measurements, a third measurement was performed on the right arm. The average of the two highest measurements was the blood pressure considered for the research.

The measurement of serum total cholesterol and fractions, triglycerides and blood glucose was performed by conventional blood collection through venipuncture. The laboratory analysis of the blood tests was performed by the enzymatic method, in automated equipment.

The collection of blood samples was performed by the researchers, following the protocol of the clinical analysis laboratory, which has level III certification from the National Accreditation Organization (NAO). Immediately after the collection, the laboratory received the samples, processed the material, and on the following day sent the test results in PDF file to the researcher in charge.

The researchers, after evaluating each exam, sent a copy of the results to the participant, via WhatsApp, informing whether all items assessed in the exam were within the reference values, or if there was a result that required medical evaluation and the participant was referred to his Basic Health Unit (BHU) of reference - to ascertain the need for drug therapy and other medical procedures, or the change was amenable to non-drug treatment and the research intervention would be sufficient to correct dyslipidemia and/or hyperglycemia, following the guidelines for prevention of CVD [1].

2.6. Definition of cardiovascular risk factors

The Framingham GRS [12] was calculated for each participant, the score evaluates the person's risk of having CVD in the next 10 years, and the subjects were stratified into three levels: low risk a person with less than 10% risk for CVD; intermediate risk if more than 10%; and high cardiovascular risk if more than 20% [13].

For evaluation of isolated cardiovascular risk factors, obesity was considered if BMI ≥30 kg/m [15], Hypertension as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg [1], abnormal lipid levels such as total cholesterol >200 mg/dl, triglycerides >150 mg/dl, HDL-cholesterol <40 mg/dl, and LDL-cholesterol >160 mg/dl [17].

2.7. Statistical Analysis

The collected data were tabulated in Excel® spreadsheets and all statistical analyses were performed using the R program. Given the total number of participants in the study ($n = 70 > 30$), the normality check was waived for the selection of the statistical test to be used, prevailing the selection by sample type. The Wilcoxon hypothesis test was used to find the p-value, as for the confidence interval, linear regression was used to find the intervals containing the parameters of the study population, and a 95% significance level was set for the effect.

2.8. Study Intervention

The intervention consisted of a cardiovascular health education program developed through telephone messages, which were sent once a week using the WhatsApp application, which is free and allows sending videos, reports, documents, images, and other communication strategies. All the content of the intervention was based on the "Clinical Prevention of Cardiovascular, Cerebrovascular, and Renal Diseases" protocol from the Ministry of Health [13], and other updated publications on the theme released by the national health body.

The educational intervention program was based on lifestyle changes, with guidance for healthy eating and regular physical activity, focusing on the prevention and control of risk factors for CVD.

The themes were alternated each week, and once a month the intervention was about some recent news story involving some famous personality, to present examples of elderly people with healthy aging, some obese person who had lost weight through lifestyle changes or someone who had died of CVD at a young age.

The videos were less than two minutes long, and the texts could be read in less than three minutes, however, approximately more than half of the intervention was carried out using pictures or illustrative images that fit on the cell phone screen, a material considered more attractive to the population involved in the study.

2.9. Research funding

The laboratory tests for total and fractionated cholesterol, triglycerides and glycemia were financed by the City Hall of Sumaré, SP, Brazil, which also organized the operation of the schools on the Saturdays the data were collected. The remaining costs of the study were financed by the researchers themselves.

3. Results

Table 1 shows that of the 70 study participants, 47 were women, the mean age was 43.2 years (±12), and the age range of 40 to 49 years corresponds to the largest group studied (31.4%).

The analysis of socioeconomic class shows that 41.4% of the participants were from class C1, and that the sum of the participants from the lower socioeconomic classes (C, D, and E) totals 67.1% of the studied group (Table 1).

Table 1 Distribution of socio-demographic characteristics of the 70 study participants, values expressed as number and percentage

Variables	*n* (%)
Gender	
Male	23 (32.9)
Female	47 (67.1)
Age group	
20 to 29 years	9 (12.9)
30 to 39 years	18 (25.7)
40 to 49 years	22 (31.4)
> 50 years	21 (30.0)
Socioeconomic class	
A1	1 (1.4)
B1	1 (1.4)
B2	21 (30.0)
C1	29 (41.4)
C2	14 (20.0)
D – E	4 (5.7)
Total	70 (100.0)

The comparison of cardiovascular RF before and after the intervention, analyzing the total number of participants who obtained improved results, shows that there was no significant change in the variables analyzed (Table 2).

The analysis of the participants of high or intermediate FRS (Table 2) showed no change, at the beginning of the study there were 09 (12.9%) parents with high or intermediate FRS and at the end of the study there were 08 (11.4%) participants in this condition (p=0.79).

In Table 3 we observe the analysis of the mean of each RF before and after the intervention, the DBP was the only RF with improvement at the end of the study, mean reduced from 80.3 mmHg to 77.7 mmHg (p=0.03), while the other three risk factors showed worsening in the result at the end of the study: HDL-cholesterol reduced mean from 55.9 mg/dL to

48.7 mg/dL (p=0.01), blood glucose increased from 91.4 mg/dL to 94.4 mg/dL (p=0.01) and body mass index was from 28.6 to 29.2 (p=0.01).

Table 2 Analysis of cardiovascular risk factors of participants before and after the intervention, values expressed as number and percentage, standard deviation and confidence interval

Variables	Before	After	*p*	Standard deviation	
				Before	After
	***n* (%)**	***n* (%)**			
Obesity					
No	46 (65.7)	42 (60.0)		2.8	2.8
Yes	24 (34.3)	28 (40.0)	0.620	3.6	4.0
Hipertension					
No	43 (61.4)	46 (65.7)			
Yes	27 (38.6)	24 (34.3)	------		
Abnormal total cholesterol					
No	27 (38.6)	33 (47.1)		18.2	16.0
Yes	43 (61.4)	37 (52.9)	0.569	27.0	27.1
Abnormal triglycerides level					
No	51 (72.9)	48 (68.6)		29.3	26.2
Yes	19 (27.1)	22 (31.4)	0.557	58.0	161.4
Abnormal HDL					
No	58 (82.9)	50 (71.4)		12.5	9.8
Yes	12 (17.1)	20 (28.6)	0.806	2.5	3.9
Abnormal LDL					
No	42(60.0)	42 (60.0)		17.9	14.0
Yes	28 (40.0)	28 (40.0)	0.164	19.6	33.0
Hyperglycemia					
No	57 (81.4)	52 (74.3)		6.4	7.6
Yes	13 (18.6)	18 (25.7)	0.648	11.9	12.7
Smoking					
No	62 (88.6)	64 (91.4)			
Yes	8 (11.4)	6 (08.6)	-------		
FRS high or intermediate					
No	61 (87.1)	62 (88.6)	0.79		
Yes	9 (12.9)	8 (11.4)			

Table 3 Analysis of cardiovascular risk factors of participants before and after the intervention, values expressed as mean, standard deviation and confidence interval

Variables	Before	After	*p*	Standard deviation		Confidence interval	
				Before	After	Before	After
Age (years)	43.2	43.2		12.0	12.0	40.3 – 46.0	40.3 – 46.0
BMI (Kg/m^2)	28.6	29.2	0.001	5.6	5.7	27.3 – 30.0	27.9 – 30.6
SBP (mmHg)	122.5	122.8	0.793	14.6	12.2	119.1 – 126.0	119.9 - 125.8
DBP (mmHg)	80.3	77.7	0.032	8.7	9.4	78.2 – 82.4	75.5 - 80.0
Total cholesterol (mg/dl)	204.7	200.0	0.184	37.9	37.4	195.7 – 213.8	191.1 - 208.9
Triglycerides (mg/dl)	126.0	147.6	0.207	67.4	116.3	109.9 – 142.1	119.8 – 175.3
HDL cholesterol (mg/dl)	55.9	48.7	0.000	14.3	11.9	52.5 – 59.3	45.9 – 51.5
LDL cholesterol (mg/dl)	124.1	128.9	0.128	33.0	39.1	116.3 – 132.0	119.6 – 138.2
Glycemia (mg/dl)	91.4	94.4	0.008	13.0	13.9	88.3 – 94.5	91.1 - 97.7
FRS (% risk in 10 years)	5.7	5.9	0.335	5.6	5.9	4.2 - 7.2	4.4 - 7.4

4. Discussion

In the characterization of the subjects (Table 1) it is observed that the predominance of the female population (67.1%), the voluntary participation in the study may be related to this result, research in the area highlights that women are more proactive in health care, adherence to treatment and prevention of CVD, a phenomenon that suggests to be determinant in the greater longevity of the female group [18,19].

It is observed that 38.6% of participants are classified as hypertensive (Table 2), prevalence higher than that observed in large national studies. The ELSA Brazil survey [20], analyzing 15,103 participants, found a total of 15.9% of hypertensive individuals in the 35 to 44 age group.

In the 2019 publication of the national surveillance survey of risk and protection factors for chronic diseases by telephone survey (Vigitel), which interviewed 52,443 people from the capital cities of the Brazilian states, 24.5% of the subjects reported a medical diagnosis of hypertension, and the publication highlights that the higher the level of education, the lower was the prevalence of SAH [21].

Vigitel 2019 [21] shows that the lower the educational level of the population, the lower is the socioeconomic class (SEC) in most cases, which increases the prevalence of cardiovascular risk factors, and this evolution has been observed in the historical series of the annual survey conducted by the Ministry of Health. In Table 1 we observe that the lowest SEC (C, D and E) total 67.1% of the studied group, thus, it can be inferred that this phenomenon can justify the high prevalence of RF in the studied group.

Obesity was an RF that affected 40% of participants at the end of the study (Table 2), a prevalence higher than that observed in the Vigitel 2019 survey [22] in which 20.3% of the interviewees declared themselves obese, this publication from the Ministry of Health concludes the analysis highlighting that these numbers "have evolved in an unfavorable and significant way. In this analysis, involving the adult population of the Brazilian state capitals, the Ministry of Health[(22)] predicts that before 2025 about two thirds will be overweight, and one fourth will be obese, a prediction that demands an urgent response from public authorities and inter-sectoral articulations to ease the problem.

Besides BMI, which had its mean increased from 28.6 kg/m^2 to 29.2 kg/m^2 (p=0.01), other risk factors that worsened at the end of the study were HDL-cholesterol and blood glucose (Table 2). HDL-cholesterol decreased in average from 55.9 mg/dL to 48.7 mg/dL (p=0.01), and blood glucose increased from 91.4 mg/dL to 94.4 mg/dL (p=0.01), however, it is noteworthy that in both cases the RF remained within the reference values appropriate for the prevention of CVD [23], considering HDL-cholesterol >40 mg/dL and blood glucose up to 99 mg/dL.

Hyperglycemia and dyslipidemia, despite the prevalence observed in the group studied (Table 3), are RF that stood out as being the leading causes of early CVD mortality in Brazil between 1990-2016, Nascimento et al. [2] analyzed the morbidity and mortality trends of CVD in this period and emphasized that these metabolic risk factors demand a reevaluation of the preventive and therapeutic public policies.

In the FRS assessment 12.9% of participants had high or moderate risk (FRS ≥ 10%), a prevalence higher than that observed in surveys with similar populations conducted in nearby cities in the Jundiai region, state of São Paulo. The Children First Study [24], conducted among parents and children in private schools, found that 8.6% of the total 302 participants had high or moderate FRS. In the Children First Study II [25], developed in public schools, 10.1% of the total of 418 participants had high or moderate FRS.

It is noteworthy that the Children First Study [24] involved families from private schools, therefore, had participants from higher socioeconomic classes than the present study and the Children First Study II [25], both conducted in public schools, thus the higher FRS observed among survey participants in public schools is a phenomenon that deserves attention and further analysis in future studies.

Blood pressure was the only variable with improved outcome at the end of this study, this seems to be the cardiovascular RF most sensitive to this type of intervention, a premise corroborated by a meta-analysis study [26] which analyzed the efficacy of the use of text messaging (SMS) for cardiovascular RF control, the research analyzed the results of nine randomized clinical trials, totaling more than 6300 participants, and found that hypertension was the variable that presented the best response to the intervention, especially in low-income groups and with difficulties in access and use of health services.

ICTs for messaging, such as WhatsApp and similar applications, are tools that require little investment for their use, and thus can be an important strategy for CVD prevention, especially in developing countries with few financial resources to develop preventive health actions [26-28].

About the limitations of the research, it is a pilot study with a small number of participants, however, it should be noted that the project was under development when the pandemic of COVID-19 began, which may have interfered with the results, because the practice of physical activities was hampered by the closure of gyms, in addition to other unforeseen events determined by the health crisis, especially the measures of social isolation that also made it impossible to carry out face-to-face activities with the participants - which were planned in this research project.

Another limitation observed at the end of the study was the predominance of participants from lower socioeconomic classes: class C (61.4%) and class D+E (5.7%), a population that often does not have adequate access to the Internet, a condition corroborated by national public entities in recent publications, such as the Institute for Applied Economic Research (IPEA) [29] and Brazilian Communication Company (EBC) [30], situation that may impede the development of the weekly intervention, which depends on the participant watching videos and accessing other media used in the educational program, a condition that may have been aggravated by the economic crisis that took hold with the pandemic of COVID-19.

This study allowed experimenting with the method, the application of new ICTs in preventive health programs need to be tested and validated, and the success of this trial was fundamental for the development of another project, involving a population with a similar socio-demographic profile and a larger number of participants.

The use of this ICT is recent, the use of WhatsApp as a tool in health care can contribute a lot in the preventive area, especially for its low cost, and thus, this technology requires further research in order to contribute to the consolidation of evidence-based practice in CVD prevention.

5. Conclusion

The educational program of cardiovascular prevention using WhatsApp did not promote reduction in the FRS of the studied group. In the analysis of risk factors for CVD, a reduction in diastolic blood pressure was observed in the participants, and no other risk factor responded satisfactorily to the intervention tested in this study.

Compliance with ethical standards

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Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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