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## **Effects of an education program on healthy eating habits on the nutritional status of workers of an Ecuadorian company in confinement**

Efectos de un programa de educación en hábitos alimentarios saludables en el estado nutricional de trabajadores de una empresa ecuatoriana en confinamiento

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### **Abstract**

Unhealthy eating and physical inactivity are the main risk factors for the development of overweight and obesity in workers. Nutritional education strategies in workplace could positively influence of consumption, nutritional status, work performance and lead to healthy dietary habits. The objective of the study was measure the effect of a virtual education program on healthy habits, nutritional status and food consumption in workers of a food processing company in Ecuador during confinement by Sars-CoV2. Methodology: Longitudinal, quasi-experimental study with pre-test and post-test design aimed at 117 administrative workers that participated voluntarily. Pre-test and post-test questionnaire was applied, included age, gender and weight, height and BMI. To assess the quality of the diet, the healthy eating index was applied according to the Food Guidelines for Ecuador (FG-Ecuador). 6 groups were formed to 25 to 30 participants that received 7 virtual educational sessions 2 hours. In 4 modules: Healthy Living, Nutrition, Gastronomy and Physical Activity. Results: The score FG-Ecuador pre-test was 65.38st, increasing post-test to 83.9st (DS=8.53) (p=0.000). About nutritional status, normal nutritional


status, in pre-test was 36%, increasing to 50.43% post-test ( $p=0.000$ ). Overweight decreased from 41% pre-test to 37.6%, obesity also 23.1% to 12% ( $p=0.027$ ). Individuals classified pre-test as normal, 11.9% were classified by FG-Ecuador as healthy, increasing 71.2% post-test. This change in nutritional status was significant. Conclusion: The findings highlight the importance of promoting educational programs on healthy habits to help workers acquire the knowledge and skills to develop healthy habits that can influence the change of habits and their nutritional status.

*Keywords:* diet healthy, body mass index, effectiveness, eating, occupational groups

## Resumen

La alimentación no saludable y la inactividad física son los principales factores de riesgo para el desarrollo de sobrepeso y obesidad en trabajadores. Las estrategias de educación nutricional en el lugar de trabajo podrían influir positivamente en el consumo, estado nutricional, rendimiento laboral y conducir a hábitos alimentarios saludables. El objetivo del estudio fue medir el efecto de un programa de educación virtual sobre hábitos saludables, estado nutricional y consumo de alimentos en trabajadores de una empresa procesadora de alimentos en Ecuador durante el confinamiento por Sars-CoV2. Metodología: Estudio longitudinal, cuasiexperimental con pretest y postest dirigido a 117 trabajadores administrativos que participaron voluntariamente. Se aplicó cuestionario pretest y postest incluyendo edad, sexo, peso, talla e IMC. Para evaluar la calidad de la dieta se aplicó el índice de alimentación saludable según las Guías Alimentarias del Ecuador (FG-Ecuador). Se formaron 6 grupos de 25 a 30 participantes que recibieron 7 sesiones educativas, virtuales de 2 horas. En 4 módulos: Vida Saludable, Nutrición, Gastronomía y Actividad Física. Resultados: El puntaje FG-Ecuador pretest fue de 65.38, aumentando el postest a 83.9 (DS=8.53) ( $p=0.000$ ). En cuanto al estado nutricional en el pretest fue del 36% para normal, aumentando al 50.43% postest ( $p=0.000$ ). El sobrepeso disminuyó del 41% pretest al 37.6%, la obesidad del 23.1% al 12% ( $p=0.027$ ). Individuos clasificados pretest como normales, el 11.9% fueron clasificados por FG-Ecuador como sanos, aumentando al 71.2% postest. Siendo significativo este cambio. Conclusión: Los hallazgos resaltan la importancia de promover programas educativos sobre hábitos saludables para ayudar a los trabajadores a adquirir los conocimientos y habilidades para desarrollar hábitos saludables que puedan influir en el cambio de su estado nutricional.

*Palabras clave:* dieta saludable, índice de masa corporal, eficacia, alimentación, grupos ocupacionales

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## INTRODUCTION

Research carried out in workplaces have identified that unhealthy eating and physical inactivity are the main risk factors for the development of overweight and obesity in workers (Gupta & Garg, 2020; World Health Organization, 2010). Obesity not only affects the health of the worker but also their well-being in various ways. Body Mass Index (BMI)  $\geq 30$  kg/m<sup>2</sup> has been found to be associated with medical expenses and productivity metrics, including absenteeism and short-term disability (World Health Organization, 2020). Within health promotion actions, nutritional education has been shown to positively influence dietary habits, nutritional status and work performance (Ballesteros-Arribas, Dal-Re Saavedra, Pérez-Farinós, & Villar-Villalba, 2007), and can lead to healthy profiles (Lin, Huang & Zhang, 2019).

Therefore, it is necessary to intervene in workspaces (MSP & FAO, 2021; PSPAS et al., 2012; Kirkpatrick, 2018), to positively influence the choice of food (Organización Mundial de la Salud, 2015; Kennedy, Ohls, Carlson & Fleming, 1995). In the workplace, four barriers to a healthy eating by the worker have been identified that require intervention: an environment with limited availability of healthy foods, the social influence of colleagues who can exert pressure to consume certain types of food, individual factors such as knowledge about the nutrients contained in food and those related to the characteristics of the organization that can lead to work stress (Dos Santos, Ulguim, Pohl, & Reckziegel, 2020). Of these, nutrient knowledge and peer influence can be addressed through education.

The modality of teleworking in administrative, impacts health at a physical, mental and emotional level, with a significant effect on eating habits and lifestyles (World Health Organization, 2020), increasing the feeling of hunger and appetite, without the opportunity to be physically active (Food and Agriculture Organization of the United Nations, 2013); Czeglédi, 2019), a situation that could arise with the confinement by Sars-CoV2 in 2020. Healthy eating includes the consumption of foods that protect against overweight, obesity and non-communicable diseases such as diabetes, heart disease, stroke, cancer (World Health Organization, 2015) and is characterized by including the consumption of fruits, vegetables (Diet, nutrition and the prevention of chronic diseases, 2003), legumes, nuts and whole grains, unsaturated fats (World Health Organization, 2020) and reduction of free sugar (World Health Organization, 2015; Diet, nutrition and the prevention of chronic diseases, 2003). Given that food consumption is a determinant of health and nutritional status (Diet, nutrition and the prevention of chronic diseases, 2003), there are dietary recommendations in each country to improve the consumption of healthy food groups, called dietary guidelines (Gupta & Garg, 2020) and their measurement has resulted in indicators of diet quality (World Health Organization, 2010, 2020; Diet, nutrition and the prevention of chronic diseases, 2003).

Among the instruments to assess the quality of the diet are the Healthy Eating Index (HEI) (Glympi, Chasioti & Bälter, 2020), the Diet Diversity Index (DDI) (Jyoshna, Kumar, Kumar & Reddy, 2017), the Healthy Eating Index Ecuador accordance with the Food Guides for Ecuador (FG Ecuador) (Egg, Wakolbinger, Reisser, Schätzer, Wild & Rust, 2020; Horta, Junior & Santos, 2019), among others. The FG Ecuador is an instrument used in population studies (Horta, Junior & Santos, 2019; Martínez-Valero, Amo-Saus, Pardo-García & Escribano-Sotos, 2021; Zapata, Moratal & López, 2020), to evaluate the consumption of food groups, adherence to the recommendations of dietary guidelines (Zapata, Moratal & López, 2020) and identify relevant information for education programs on consumption habits (Martínez-Valero, Amo-Saus, Pardo-García & Escribano-Sotos, 2021; Ejeda-Manzanera & Rodrigo-Vega, 2021; Varoucha-Azcarate, 2019). There is a close relationship between the quality of the diet and the presence of obesity (Velasco-Estrada, Orozco-González & Zúñiga-Torres, 2018; Jia et al., 2020), establishing

nutritional education strategies in the workplace could positively influence the pattern of consumption, nutritional status (Glympi, Chasioti, & Bälter 2020; Ross et al., 2019; Taeymans, Luijckx, Rogan, Haas & Baur, 2021), work performance (Jyoshna et al., 2017) and driving towards healthy dietary habits (Egg et al, 2020) related to food choices (Dos Santos, Ulguim, Pohl, & Reckziegel, 2020); Food and Agriculture Organization, 2013) in workers. According to the WHO (World Health Organization, 2010) "A healthy work environment must include health protection and health promotion", therefore, establishing programs to promote healthy habits within companies can be a promising strategy to control overweight and obesity in workers. For the implementation of health training programs in companies and institutions, virtual education can be a strategic alternative, to facilitate the learning of employees due to its ability to reach, flexibility and schedule adaptation (Lin, Huang & Zhang, 2019; Czegledi, 2019). Therefore, the objective of this study was to measure the effect of a virtual education program on healthy habits on nutritional status and food consumption in workers of a food processing company during confinement by (Sars-CoV2).

## **MATERIAL AND METHODS**

A longitudinal, quasi-experimental study with a pre-test-post-test design was carried out in administrative workers of a food processing company in Ecuador. 217 workers were invited, 172 agreeing to participate, so they do not represent all employees. The participants signed informed consent. The inclusion criteria were administrative workers who agreed to perform anthropometric measurements and attend virtual training. Workers with rotating shift, bariatric surgery, reduction drug treatment or with endocrine diseases, congenital liver diseases, type I diabetes, cancer, with nutritional treatment or who have received nutritional counseling were excluded to avoid information bias, being at the end 117 participants.

### **Data collection**

To evaluate the effects of the program, a questionnaire was applied before the intervention and post-test once the program was finished. The instrument included sociodemographic (age, gender), anthropometric (weight, height) variables, with which the BMI (Kg/m<sup>2</sup>) was calculated and classified, according to the WHO (World Health Organization, Serie de Informes Técnicos 854, 1995). To assess the quality of the diet, the Healthy Eating Index was applied, according to the Food Guidelines for Ecuador (FG Ecuador) (MSP & FAO, 2021; PSPAS et al., 2012), which is based on the North American Healthy Eating Index (HEI) methodology (Krebs-Smith et al., 2019), adapting it to the Ecuadorian reality. For the FG Ecuador score, it was evaluated as follows: 10 pts. for daily consumption (cereals and tubers, vegetables, fruits, milk and derivatives, meat); 7.5 points. for consumption > 3 times a week; 5 points. for consumption 1 or 2 times a week; 2.5 points. for less than 1 time a week and 0 pts. never or hardly ever. For weekly consumption (legumes) 10 pts.; for 1 or 2 times a week 7.5 pts.; for > 3 or more times a week; < 1 time a week 5pts; daily consumption 2.5pts and never or almost never 0pts. Occasional consumption (sausages and cold cuts, sweets, and soft drinks with sugar) 10 pts. never or almost never; 7.5 points. < 1 time a week; 5 points. 1 or 2 times a week; 2.5 points. for 3 or more times a week and 0 pts. for daily consumption. The variety was assigned 10 points. The total sum is 100 pts. It was classified into three categories: >80 points "healthy"; ≤80 to >50 points "needs changes"; ≤50 points "unhealthy" (Kennedy, Ohls, Carlson & Fleming, 1995).

### **Intervention**

The program was designed and applied by professionals in the areas of nutrition, sports training, pedagogy, and gastronomy and was carried out from April to September 2020. 6 groups were

formed with 25-30 participants, depending on the convenience of the schedule. Each group received virtual sessions through zoom video calls, (given the situation of confinement by Sars-CoV2). Each session lasted 2:00 hours. The program included 4 modules: Introduction to Healthy Living, Nutrition, Gastronomy, Physical Activity. The first module included the following topics: Ecuador's food and nutrition situation, importance of self-care (food and exercise), work-life balance, and adult learning. The Nutrition module included: Food groups, nutrients, label reading, consumption portions, healthy plate composition. The Gastronomic module included cooking techniques (oven, steam, iron) and blanching in the preparation of vegetables, considering the recommendations of the Food-Based Dietary Guidelines (FBDG) of Ecuador (PSPAS et al., 2012). In this module, what was learned in nutrition was put into practice through the concept of "learning by doing", with the preparation of appetizing, practical and healthy recipes. The Physical Activity module included: WHO recommendations, importance of warming up, stretching, types of training (strength, resistance) considering intensities, with the implementation of training circuits. Modules 1 and 3 had one asynchronous session and the remaining modules two synchronous sessions per week. As part of the program, once the modules were finished, each group was monitored for a month through WhatsApp, where the participants shared their mealtimes and their daily exercise routines through photographs, so that the assigned professional (nutritionist, coach) make the respective recommendations, generating collective learning.

### Statistical Analysis

The absolute and relative frequency of the qualitative variables sex, age and nutritional status were obtained; Given the normal behavior, the descriptive statistics (mean, standard deviation) of the FG Ecuador were obtained for the categories of the aforementioned variables and these means were compared with the t-test for comparison of independent means and the 1-factor Anova analysis of variance. Before and after the intervention was compared with the t test for comparison of dependent means and the Wilcoxon signed rank test for related samples. On the other hand, categorized FG Ecuador was presented with absolute and relative frequency for sex, age, and nutritional classification, comparing the differences in proportions with Fisher's exact test or the chi-square test of homogeneity between levels, as appropriate. The healthy vs. unhealthy category was compared before and after the intervention with the McNemar test, in general and by categories of the variables already described. Likewise, to compare the frequency of consumption by pre-test and post-test food groups, the McNemar test was used, comparing the recommendation for each food group vs. the grouping of the other responses. All statistical significance tests were applied with a significance level of  $\leq 0.05$ . Epidat® 3.1 software and SPSS® version 26 were used.

### RESULTS

The characteristics of the 117 participating workers are described in Table 1. When 69.2% of the participants are women and 30.8% men. According to the score obtained from the FG Ecuador before the intervention, it was 65.38pts, with a SD of 11.5 points, increasing after the intervention to 83.9pts, with a SD of 8.53pts ( $p=0.000$ ). The mean of the FG Ecuador pre-test and post-test for women was higher than for men ( $p=0.000$ ). Similarly, the mean increase in women was 66 pts, to 83.9 pts post-test ( $p=0.000$ ). The same behavior was observed in men, from 63.98 to 78.09 pts ( $p=0.000$ ).

The mean age between the four categories was the same, both in pre-test and post-test ( $p=0.4117$  and  $p=0.684$  respectively), however, the comparison of means between pre-test and post-test for each of the categories was significant ( $p=0.001$  for 20-29 years and  $p=0.000$  for the



others). In relation to nutritional status, in the pre-test, 41.03% of the participants were overweight and post-test the highest proportion was normal (50.43%). The increase that occurred in the mean of the FG Ecuador in the three categories of nutritional status pre-test and post-test was significant ( $p=0.000$ ). In addition, the mean pre-test BMI was 26.71 kg/m<sup>2</sup>, decreasing post-test to 25.82 kg/m<sup>2</sup>, although there is overweight, the change due to the intervention was significant ( $p=0.001$ ). Table 1.

**Table 1**

*Comparison of FG Ecuador means by variables of interest, before and after the intervention*

Characteristic	FG Ecuador in Pre-test				FG Ecuador in Post-test				p*
	N	(%)	Media	SD	n	(%)	Media	SD	
Total	117	(100)	65.38	11.53	117	(100)	82.12	8.53	0.000
Sex									
Women	81	(69.2)	66	11.9	81	(69.2)	83.9	7.04	0.000
Men	36	(30.8)	63.98	10.69	36	(30.8)	78.09	10.18	0.000
p-value**			0.000					0.000	
Age									
20 to 29 years	14	(12)	62.82	11.31	14	(12)	81.32	6.83	0.001 <sup>^</sup>
30 to 39 years	48	(41)	63.95	12.18	48	(41)	81.34	9.54	0.000 <sup>^</sup>
40 to 49 years	37	(31.6)	67.22	10.49	37	(31.6)	82.48	8.35	0.000 <sup>^</sup>
50 to 59 years	18	(15.4)	67.36	11.99	18	(15.4)	84.05	7.41	0.000 <sup>^</sup>
p-value***			0.412					0.684	
Nutritional condition									
Normal	42	(35.9)	66.01	11.03	59	(50.43)	82.83	7.89	0.000 <sup>^</sup>
Overweight	48	(41.0)	66.55	12.34	44	(37.61)	81.65	8.63	0.000 <sup>^</sup>
Obese	27	(23.0)	62.31	10.64	14	(11.97)	80.57	10.89	0.000 <sup>^</sup>
p-value***			0.285					0.611	
BMI (kg/m <sup>2</sup> )	117	(100)	26.71	4.83	117	(100)	25.82	3.66	0.001

\*p for dependent means comparison t-test; \*\*p for independent means comparison t-test; \*\*\*p for 1-way ANOVA analysis of variance test; <sup>^</sup>p from the Wilcoxon signed rank test for related samples.

The proportion of individuals classified as healthy vs. unhealthy/needs changes (Table 2); pre-test was 9.4%. Post-test, the healthy group increased to 68.4% ( $p=0.000$ ). In relation to sex, the proportion of healthy women went from 12.3% pre-test to 75.3% post-test ( $p=0.000$ ). Similarly, the proportion of healthy men went from 2.8% to 52.8% pre-test and post-test ( $p=0.000$ ). On the other hand, in pre-test and post-test, women were healthier than men ( $p=0.001$  and  $p=0.000$ , respectively).

According to age distribution, the healthiest pre-test and post-test age category was 50-59 years (16.7% and 72.2%, respectively) and the least healthy 20-29 years (7.1% and 57.1%, respectively). When comparing the proportion of healthy individuals in each of the pre-test and post-test age categories; all categories presented statistically significant changes ( $p=0.016$  for 20 to 29 years,  $p=0.000$  for 30 to 39 years and 40 to 49 years,  $p=0.002$  for 50-59 years).

Regarding nutritional status, the proportion of individuals in normal nutritional status, in pre-test was 36%, increasing to 50.4% post-test. Overweight decreased from 41% pre-test to 37.6% and

obesity also decreased from 23.1% to 12%. This change in nutritional status was significant ( $p=0.027$ ). In addition, of the total number of individuals classified pre-test as normal, 11.9% were classified by FG Ecuador as healthy, increasing to 71.2% post-test. The proportion of people classified as overweight and healthy, pre-test was 10.4%, increasing to 65.9% post-test. The same happens with the healthy obese, it increased from 3.7% to 64.3%. This change in the three categories of nutritional status was significant ( $p=0.000$ ). Table 2.

**Table 2**

*Comparison of proportions of the classification of the Healthy Eating Index -IAS Ecuador before and after the intervention*

Characteristic	Before the interventions								After the interventions				p-value* **		
	Healthy		Need changes		Unhealthy		Healthy		Need changes						
	n	(%)	n	(%)	n	(%)	n	(%)	n	%	N.	%			
<b>Total</b>	117	(100)	11	(9.4)	93	(80)	13	(11.1)	117	(100)	80	(68.4)	37	(36.1)	0.000
<b>Sex</b>															
Women	81	(69.2)	10	(12.3)	63	(78)	8	(9.9)	81	(69.2)	61	(75.3)	20	(24.7)	0.000
Men	36	(30.8)	1	(2.8)	30	(83)	5	(13.9)	36	(30.8)	19	(52.8)	7	(47.2)	0.000
<i>p-value*</i>			0.001		0.000		0.433				0.000		0.642		
<b>Age</b>															
20 to 29 years	14	(12)	1	(7.1)	11	(79)	2	(14.3)	14	(12)	8	(57.1)	6	(42.9)	0.016
30 to 39 years	48	(41)	4	(8.3)	37	(77)	7	(14.6)	48	(41)	32	(66.7)	16	(33.3)	0.000
40 to 49 years	37	(31.6)	3	(8.1)	28	(87)	2	(5.4)	37	(31.6)	27	(73)	1	(27)	0.000
50 to 59 years	18	(15.4)	3	(16.7)	11	(72)	2	(11.1)	18	(15.4)	13	(72.2)	5	(27.8)	0.002
<i>p-value**</i>			0.723		0.629		0.586				0.716				
<b>Nutritional condition</b>															
Normal	42	(35.9)	5	(11.9)	33	(79)	4	(9.5)	59	(50.4)	42	(71.2)	17	(28.8)	0.000
Overweight	48	(41)	5	(10.4)	38	(79)	5	(10.4)	44	(37.6)	29	(65.9)	15	(34.1)	0.000
Obese	27	(23.1)	1	(3.7)	22	(82)	4	(14.8)	14	(12)	9	(64.3)	5	(35.7)	0.000
<i>p-value**</i>			0.501		0.956		0.778				0.80				

\*The p value compares the difference in proportions by FG Ecuador category according to sex with Fisher's exact test. \*\*The p value compares each FG Ecuador category vs the others for age and nutritional status with the chi-square test of homogeneity between levels. \*\*\* The p value compares the healthy vs. unhealthy category before and after the intervention with the McNemar test.

The proportion of daily consumption of cereals and derivatives increased from 33.3% to 80.3% pre-test and post-test ( $p=0.000$ ). Similarly, the post-test proportion for the daily consumption of vegetables, fruits, milk, and derivatives increased ( $p=0.000$ ). The recommended consumption of legumes 1 or 2 times a week also increased ( $p=0.000$ ). For soft drinks and sweets, the recommended consumption is 1 or 2 times a week and increased ( $p=0.000$  and  $p=0.007$  respectively). The only group in which there were no significant changes ( $p=1.000$ ) was in the never or almost never consumption of sausages and cold cuts, which continue to be consumed more frequently 1 or 2 times a week, both before and after of the intervention. Table 3.

**Table 3**

*Frequency of consumption by food groups before and after the intervention*

Food group	Before	After	p-value*
	n (%)	n (%)	
<b>Cereals and derivatives</b>			
Daily consumption	39 (33.3)	94 (80.3)	0.000
3 or more times a week but not daily	27 (23.1)	17 (14.5)	
1 or 2 times a week	26 (22.2)	3 (2.6)	
Less than once a week	14 (12)	3 (2.6)	
Never or hardly never	11 (9.4)	- -	
<b>Vegetables and derivatives</b>			
Daily consumption	44 (37.6)	97 (82.9)	0.000
3 or more times a week but not daily	48 (41)	15 (12.8)	
1 or 2 times a week	18 (15.4)	5 (4.3)	
Less than once a week	6 (5.1)	- -	
Never or hardly never	1 (0.9)	- -	
<b>Fruits</b>			
Daily consumption	46 (39.3)	94 (80.3)	0.000
3 or more times a week but not daily	46 (39.3)	17 (14.5)	
1 or 2 times a week	13 (11.1)	6 (5.1)	
Less than once a week	10 (8.5)	- -	
Never or hardly never	2 (1.7)	- -	
<b>Milk and derivatives</b>			
Daily consumption	51 (43.6)	73 (62.4)	0.000
3 or more times a week but not daily	31 (26.5)	34 (29.1)	
1 or 2 times a week	21 (17.9)	8 (6.8)	
Less than once a week	10 (8.5)	- -	
Never or hardly never	4 (3.4)	2 (1.7)	
<b>Meat</b>			
Daily consumption	66 (56.4)	106 (90.6)	0.000
3 or more times a week but not daily	32 (27.4)	7 (6)	
1 or 2 times a week	11 (9.4)	3 (2.6)	
Less than once a week	4 (3.4)	1 (0.9)	
Never or hardly never	4 (3.4)	- -	
<b>Legumes</b>			
Daily consumption	31 (26.5)	31 (26.5)	0.000



3 or more times a week but not daily	55 (47)	36 (30.8)	
1 or 2 times a week	23 (19.7)	50 (42.7)	
Less than once a week	7 (6)	- -	
Never or hardly never	1 (0.9)	- -	

<b>Sausages and cold cuts</b>			
Daily consumption	5 (4.3)	3 (82.6)	
3 or more times a week but not daily	15 (12.8)	17 (14.5)	
1 or 2 times a week	53 (45.3)	59 (50.4)	1.000
Less than once a week	29 (24.8)	22 (18.8)	
Never or hardly never	15 (12.8)	16 (13.7)	

<b>Sweets</b>			
Daily consumption	10 (8.5)	1 (0.9)	
3 or more times a week but not daily	25 (21.4)	8 (6.8)	
1 or 2 times a week	37 (31.6)	50 (42.7)	0.007
Less than once a week	29 (24.8)	26 (22.2)	
Never or hardly never	16 (13.7)	32 (27.4)	

<b>Soft drinks</b>			
Daily consumption	7 (6)	2 (1.7)	
3 or more times a week but not daily	21 (17.9)	2 (1.7)	
1 or 2 times a week	32 (27.4)	28 (23.9)	0.000
Less than once a week	28 (23.9)	22 (18.8)	
Never or hardly never	29 (24.8)	63 (53.8)	

\* *p* corresponding to the McNemar test which compares the recommendation vs the grouping of the other answers. ~ Category considered ideal for each food group according to the Ecuadorian Food Guidelines.

## DISCUSSION

This research shows the effect that education in healthy habits can have on the nutritional status of administrative workers. Weight gain in people with this work profile is associated with predominantly sedentary occupational activities that transcend the decrease in muscle mass, increase in fat mass (Kim et al., 2018), as a result of remaining seated for up to 82% of their working hours (Bergman et al., 2018) having a direct effect on BMI and compulsive eating behaviors, as a result of stress (Glympi et al., 2020; Nooijen, Blom, Ekblom, Ekblom & Kallings, 2019). As the BMI increases, the well-being of the worker and the expenses in health services are affected (Gupta & Garg, 2020). In general terms, it is estimated that being overweight causes a 20% increase in health care costs and in obese individuals 50% (Alonso-Pérez, M.A. & Furió-Blasco E., 2018). Therefore, the strategy of education in healthy habits is required to generate knowledge and facilitate adequate decision-making in the worker (Calpa-Pastas et al., 2019), the results obtained in our study showed that an intervention in nutritional education and physical activity (with the development of practical component of gastronomy and physical activity, in addition to the follow-up after the completion of the modules) significantly improves the quality of the food consumed and the nutritional status of the participants. In this study we found that there was a significant improvement in the dietary profile, since at the end of the intervention, the results show

that the healthy eating index improved, getting closer to compliance with the recommendations proposed by the Ecuadorian foods guidelines. Perhaps, this is because in the intervention, in addition to including theoretical education on food and nutrition, practice was used in food preparation from the gastronomy module. On the other hand, it is known that a higher score on the healthy eating index is related to positive effects on BMI (Xu, Steffen, Selvin & Rebholz, 2020), a situation that was confirmed in the present study. It should be noted that an improvement in the quality of the diet may not necessarily decrease the BMI in all individuals, but it may favor the prevention of diet-related diseases (Velasco-Estrada, Orozco-González & Zúñiga-Torres, 2018). Another important finding is that, when evaluating the pre-test consumption based on the recommendations of the FBDG -Ecuador (PSPAS et al., 2012), there is a low percentage of workers who have a daily consumption of cereals and derivatives; vegetables, fruits; milk and derivatives, meat, as well as there is a high percentage of people who consume sweets and soft drinks at least 1 or 2 times/week, being predominantly a profile that requires changes. This last finding demonstrated the inclusion of foods with little nutritional value but that contribute to increasing the total energy of the diet (Sánchez-Pimienta, Batis, Lutter, & Rivera, 2016). It should be noted that these results are similar to the national data provided by the National Health and Nutrition Survey (NHNS) 2013 (Freire et al., 2013), where it became visible that Ecuadorians have an excessive consumption of refined carbohydrates, sugars and insufficient consumption of protein, vegetables and fruits.

On the other hand, regarding the consumption of cereals and derivatives before the intervention, an "unhealthy" consumption was identified, related to excess. This behavior may be because it is a producing country, which facilitates access, since when considering the 2020 Food Balance sheet of the Ecuadorian Ministry of Agriculture (Ministerio de Agricultura y Ganadería, s.f.), a daily per capita supply of 229 g/day is recorded (wheat, rice, sweet corn, or corn), especially rice (124 g/day) (PSPAS et al., 2012).

In this study, the results of the post-test evaluation showed that the consumption of cereals and derivatives improved, which is probably because the participants were trained in the control of food portions before consuming them (Smethers & Rolls, 2018). Regarding the consumption of protein-source foods, the pre-test findings identified a consumption that "needs changes" or is "unhealthy". There is a daily per capita supply of 545 g/day in animal products (milk, chicken, beef, fish, pork, eggs, tuna, shrimp) that covers the demand (Ministerio de Agricultura y Ganadería, s.f.) and although the findings in the study are not very favorable, they are better than the Ecuadorian national reality, since the prevalence of inappropriate consumption is 6.4% (Freire et al., 2013). This behavior may be related to ignorance of the importance of its inclusion in the daily diet and/or factors related to family income (PSPAS et al., 2012). In this study, the results of the post-test demonstrated a change in behavior, since the daily consumption of foods that are protein sources increased", which is probably due to the fact that the workers received nutritional education and that the population participating in the study have the possibility of having sufficient economic resources to include this type of food in their diet (because in Ecuador, these foods are the most expensive for the population). Regarding the consumption of vegetables and fruits, the workers have a consumption "little healthy". In 2020, the Ecuadorian population had a daily per capita supply of vegetables 13 g/day and fruit 136 g/day, being insufficient to cover the recommendation established by the World Health Organization (WHO) of a minimum per-capita consumption of 5 servings or 400 g of fruits and vegetables per day (Rodríguez-Leyton, 2019). This implies that 1 in 1000 Ecuadorians have an adequate intake of fiber (Freire et al., 2013) and therefore there is a low consumption in the general population. These results harmonize with the statements of the WHO and the Food and Agriculture Organization of the United Nations (FAO), regarding the existence of a low percentage of fruit and vegetable consumers in the world (Diet, nutrition and the prevention of chronic diseases, 2003). In the post-test results of this study,

a significant increase in the daily consumption of fruits and vegetables was evidenced, which is possibly due to what was taught and the practical experience related to the preparation of a variety of quick and healthy recipes that included these foods, in addition to reinforcing education in portions/day of whole grains, vegetables, and fruits and their relationship with a 38% decrease in the risk of overweight/obesity compared to non-consumption (Brennan et al., 2021). At this point, it should be considered that the intake of fruits tends to be higher compared to vegetables due to their sweet taste, softer texture and easy way of eating, a situation that favors their preference (Rodrigues et al., 2019). The findings of this study highlight the importance of promoting educational programs on healthy habits within companies to help workers acquire the knowledge and ability to acquire habits that contribute to improving their nutritional status. In addition, more studies are required with this intervention approach, which allow the identification of improvements and possible solutions considering the different types of work.

### **LIMITATIONS**

The present study has some limitations. The BMI can be used as a detection tool for overweight and obesity, but it is recommended in future studies to accompany it with measures such as body composition, waist assessment to identify a threat to health due to central obesity. The diet quality index does not include the description of dietary fat content, an aspect that should be considered for future research, however, it was possible to identify changes in the dietary profile through the pre-test vs. post-test evaluation. Future research is recommended to evaluate the maintenance of the change in habits over time. The presence of information bias in the BMI is possible since calibrated instruments were not used to measure weight and height. It is considered that the results of this study represent the behavior of the participants, but not the universe of the company. Among the strengths of the study, the inclusion of several components (nutrition, gastronomy, physical activity) is recognized, which allow promoting the change of habits in an integral way.

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