Health Action Process Approach for Predicting Exercising in Mexican Adults with Cardio-metabolic Risk*[12]

Dagmara Wrzecionkowska
Doctora en Ciencias Políticas y Sociales
UNAM, Ciudad de México, México
Correo electrónico: dagmara0510@gmail.com

Nazira Calleja
Doctora en Psicología Social
UNAM, Ciudad de México, México
Correo electrónico: ncalleja@unam.mx

Adriana Robles Cabrera
Licenciada en Medicina
UNAM, Ciudad de México, México
Correo electrónico: adriana.robles@c3.unam.mx

Rolando Díaz Loving
PhD en Psicología Social
UNAM, Ciudad de México, México
Correo electrónico: rdiazl@unam.mx

Sofía Rivera Aragón
Doctora en Psicología Social
UNAM, Ciudad de México, México
Correo electrónico: sofiar@unam.mx

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Abstract

A test of the Health Action Process Approach (HAPA) model for predicting physical exercise and its effects on body, cardio-metabolic, and psychological outcomes in a sample of Mexican adults at cardio-metabolic risk who wanted to lose weight was conducted. The HAPA variables (self-efficacy, outcome expectancies, risk perception, intention, maintenance self-efficacy, action planning); outcome variables: body health (weight & fat), cardio-metabolic health (cholesterol LDL & triglycerides), perceived psychological health (quality of life & psychological distress); BMI and waist/height ratio were measured at baseline, week 6, and week 12 after the intervention. A total of 82 adults met inclusion criteria: BMI ≥ 25 and/or weight/height ratio ≥ .5cm, out of these, 50 finished the program. The model tested via structural equations did not exhibit adequate fit: CFI = .782, GFI = .858, SRMR = .111. However, the expectations variable had a significant effect on intentions and action-self efficacy on maintenance self-efficacy, accounting for 24% and 17% of the variance respectively, other model relationships were not found significant. In addition, changes in exercising had a positive effect on body health, explaining 11% of the variance. Further studies are necessary to understand other crucial predictors for physical activity in samples outside western, educated, industrialized, rich, and democratic countries.

Keywords

HAPA, exercising, overweight, structural equations.

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Enfoque del proceso de acción en salud para predecir el ejercicio en adultos mexicanos con riesgo cardio-metabólico

Resumen

Se realizó una prueba del modelo *Health Action Process Approach* (HAPA) para predecir el ejercicio físico y sus efectos sobre los resultados corporales, cardiometabólicos y psicológicos en una muestra de adultos mexicanos con riesgo cardiometabólico que deseaban adelgazar. Se hicieron medidas al inicio del estudio, en la semana 6 y en la semana 12 después de la intervención de las variables HAPA (autoeficacia, expectativas de resultados, percepción de riesgo, intención, autoeficacia de mantenimiento, planificación de acciones); las variables de resultado como la salud corporal (el peso y la grasa), la salud cardiometabólica (colesterol LDL y triglicéridos), la salud psicológica percibida (calidad de vida y estrés psicológico); el IMC y la relación cintura/altura. Un total de 82 adultos cumplieron los criterios de inclusión: IMC ≥ 25 y/o relación peso/talla ≥ .5 cm, de estos, 50 finalizaron el programa. El modelo probado mediante ecuaciones estructurales no mostró un ajuste adecuado: CFI = .782, GFI = .858, SRMR = .111. Sin embargo, la variable expectativas tuvo un efecto significativo sobre las intenciones y la autoeficacia de la acción sobre la autoeficacia de mantenimiento, representando el 24% y el 17% de la varianza, respectivamente; sin encontrar otra relación. Además, los cambios en el ejercicio tuvieron un efecto positivo en la salud corporal explicando el 11% de la varianza. Se necesitan más estudios para comprender otros predictores cruciales de la actividad física en muestras fuera de los países occidentales, educados, industrializados, ricos y democráticos.

Palabras clave

HAPA, ejercicio, sobrepeso, ecuaciones estructurales.

Abordagem do processo de ação de saúde para predizer exercícios em adultos mexicanos com risco cardio-metabólico

Resumo

Foi realizado um teste do modelo Health Action Process Approach (HAPA) para prever exercícios físicos e seus efeitos no corpo, resultados cardiometabólicos e psicológicos em uma amostra de adultos mexicanos em risco cardiometabólico que desejavam perder peso. As variáveis HAPA (autoeficácia, expectativas de resultados, percepção de risco, intenção, autoeficácia de manutenção, planejamento de ações); variáveis de resultado: saúde corporal (peso e gordura), saúde cardio-metabólica (colesterol LDL e triglicerídeos), saúde psicológica percebida (qualidade de vida e sofrimento psicológico); O IMC e a relação cintura / altura, foram medidos no início do estudo, nas semanas 6 e 12 após a intervenção. Um total de 82 adultos preencheram os critérios de inclusão: IMC ≥ 25 e / ou relação peso / altura ≥ .5cm, destes, 50 concluíram o programa. O modelo testado por meio de equações estruturais não exibiu ajuste adequado: CFI = .782, GFI = .858, SRMR = .111. No entanto, a variável de expectativas teve um efeito significativo sobre as intenções e autoeficácia de ação na autoeficácia de manutenção, respondendo por 24% e 17% da variância, respectivamente; outras relações de modelo não foram consideradas significativas. Além disso, as mudanças na prática de exercícios tiveram um efeito positivo na saúde corporal, explicando 11% da variância. Mais estudos são necessários para compreender outros preditores cruciais para a atividade física em amostras fora de países ocidentais, educados, industrializados, ricos e democráticos.

Palavras chave

HAPA, exercício, excesso de peso, equações estruturais.

Introduction

Exercise is defined as planned, structured, repetitive and intentional movement intended to improve or maintain physical fitness (World Health Organization, 2018). It is associated with such benefits as increased self-esteem, decreased anxiety and depression, decreased risk of cardiovascular disease, hypertension, diabetes, breast and colon cancer (Bonvecchio et al., 2015). On the other hand, insufficient physical activity has a negative effect on quality of life and health, and it has become one of the leading risk factors for death worldwide (WHO, 2018).

To obtain health benefits from exercising, WHO (2018) recommends for adults to engage in at least 150 minutes of moderate-intensity physical activity per week, or at least 75 minutes of vigorous activity. Yet, in Mexico, only 41.7% of adults exercise or do sports (Instituto Nacional de Estadística y Geografía, 2019). Lack of exercise co-occurs with one of the highest obesity rates worldwide (Organization for Economic Co-operation and Development, 2017). Identifying the theory-based modifiable psychological factors that influence limited physical activity in this population can help inform interventions that motivate adoption of healthy habits such as exercising.

The Health Action Process Approach Model

The health action process approach (HAPA) model acknowledges the gap between intentions and behavior (Schwarzer, 2008), and incorporates a post-intentional construct, a volitional phase, in addition to the motivational stage to predict a behavior. The motivational aspect describes the intention formation via changes in action self-efficacy (optimistic beliefs about one's capabilities to perform the action), positive outcome expectations (beliefs in the effect of an action on achieving a desired outcome), as well as risk perception (perceived susceptibility to a threat). The volitional phase refers to processes that lead to the actual health behavior and includes volitional self-efficacy and creation of behavioral plans. Volitional self-efficacy includes maintenance self-efficacy that represents optimistic beliefs about one's capability to deal with barriers that occur during the maintenance phase. Plans formation, also sometimes referred to as Implementation Intentions, links a behavior focused on a certain goal with a stimulus to facilitate the automatic activation of the desired response (Gollwitzer, 1999).

Although the HAPA model has been tested for predicting physical activity in multiple occasions and the research provided support for the model in predicting health behaviors in various domains, it has been predominantly assessed in Western Educated Industrialized Rich Democratic cultures (WEIRD, Henrich, Heine & Norenzayan, 2010). Only few studies apply the model with populations outside WEIRD countries. For example Duan, Wienert, Hu, Si & Lippke, (2017) predicting physical activity among Chinese University Students, or Gutiérrez, Lippke, Renner, Kwon & Schwarzer (2009) in Costa Rican and South Korean for predicting dietary behaviors. To our knowledge our study is the first to test the model for physical exercise prediction with Latin American population.

Moreover, the present study tested the dynamic relationships between variables measuring all the variables at three points in time and taking into account the changes in the variable and not the static relationship between them. As far as we are aware only few studies have applied this approach so far (Hattar, Pal & Hagger, 2016).

Objective and Hypothesis

The present study looked to test the ability of the HAPA model to predict physical exercising in people with cardiometabolic risk who want to lose weight. Analyses included evaluation of the changes in the HAPA variables for predicting changes in physical exercising and predicting the effect of changes in exercising on changes in health parameters: body health (weight and fat), cardio-metabolic health (LDL cholesterol and triglycerides), and perceived mental health (quality of life and psychological distress). Our hypothesis was that the HAPA variables will predict exercising, as proposed in the model. Additionally, we expected that changes in exercise will have effect on the earlier mentioned health variables.

See Figure 1 for all the hypothesized relationships.

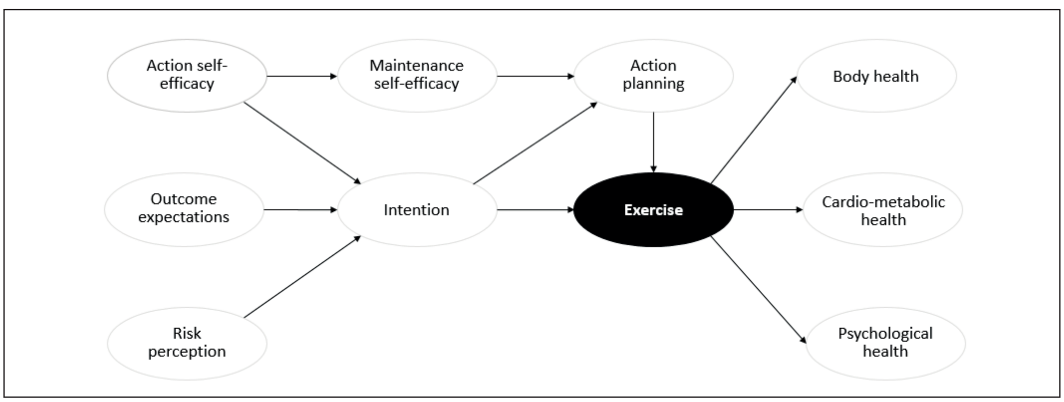

Figure 1. Hypothesized relationships between variables according to the Health Action Process Approach

Methods

Design

The current study had a longitudinal design, with the participants being followed over 12 weeks. The data were collected at baseline and after having administered the intervention at weeks 6 and 12. At each time point, all the model variables were assessed.

Participants

Participants were recruited via advertisements at National Autonomous University of Mexico in Mexico City, which promoted a 12-week weight loss program for overweight. Inclusion criteria comprised of: BMI ≥ 25 kg/m^2 and/or waist/height ratio ≥ .5 cm as indicators of cardio-metabolic risk (Ashwell & Gibson, 2016), and age 18-70 years old. Exclusion criteria were: diseases like hypothyroidism, heart disease, anxiety and depression; taking medication that could limit weight loss or exercising; physical inability to exercise; and being enrolled in other weight loss program. Out of 107 who contacted the primary investigator eighty-two met inclusion criteria. Seventy-six came to the first appointment, out of these fifty participated in all sessions. Analysis was conducted with data of fifty participants.

The final sample consisted of 35 women and 15 men. Participants were 40 ±14 years of age and had a mean BMI of 29.2 ±4.4 kg/m^2. Three participants had waist/height ratio below .5 cm, yet BMI ≥ 25; and five had BMI < 25, yet with waist/height above .5 cm. Twenty participants (40%) did not realize any exercise at base line, 20% indicated exercising between one to three hours per week, remaining 40% reported exercising more than three hours per week. These numbers must be viewed with caution as various studies indicate that self-reports overestimate levels of exercise (Schaller et al., 2016).

Measures

HAPA variables

The HAPA model variables were assessed with the 24-items designed by Hattar et al. (2016). All items were assessed using a scale ranging from 1 (strongly disagree) to 5 (strongly agree). Risk perception was assessed using four items (e.g. “I think it is likely that I will develop health problems related to obesity at some point in my life”), outcome expectancy using three (e.g. “I think that engaging in daily physical activity with a minimum of 30 minutes of planned exercise will help me to lose weight”), intention two (e.g. “I intend to participate in daily physical activity with a minimum of 30 minutes of planned exercise on each individual occasion over the next 6 weeks”), and action planning one (“I have made a detailed plan about when, where, and how I will do daily physical activity with a minimum of 30 minutes of planned exercise on each individual occasion over the next 6 weeks”). Action and maintenance self-efficacy were measured with five and nine items respectively e.g. for action self-efficacy “If it were entirely up to you, how confident are you that you would be able to participate in daily physical activity with a minimum of 30 minutes of planned exercise on each individual occasion over the next 6 weeks?” and for maintenance self-efficacy “How confident are you that you will do daily physical activity with a minimum of 30 minutes of planned exercise during your leisure time on each individual occasion over the next 6 weeks even if...” with a number of barriers listed e.g. feeling tired; the responses ranged from 1 (not confident) to 5 (completely confident). In the present sample internal consistency estimates measured with Cronbach’s α were: at 1st appointment = .65-.95 (except for intention .56), at second .62-.93, at third .77-.93.

Body health

Body health was evaluated measuring participants’ weight (kg) and fat (%)

with OMRON HBF-514C scale and height with a portable stadiometer (SECA 213, Height-Rod); and waist circumference with SECA 201 ergonomic circumference measuring tape.

Cardio-metabolic health

Cardio-metabolic health was assessed with triglycerides and LDL cholesterol, parameters that are impacted by exercise (Wang & Xu, 2017). For the biochemical analysis, 5 ml of venous blood was extracted after 8-12 hours fasting. The samples were analyzed in a clinical biochemistry laboratory (Advia Chemistry, Direct LDL Cholesterol Reagents and Triglycerides 2 Reagents, Siemens).

Physical exercise

Physical exercise was measured with an item “How many hours per week do you exercise?”.

Psychological health

Perceived mental health was evaluated with The Impact of Weight on Quality of Life-lite questionnaire (IWQOL-lite; Kolotkin, Crosby, Kosloski & Williams, 2001) and Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995). 31-item IWQOL overviews five life areas: physical function, self-esteem, sexual life, public distress, and work. Items were evaluated on a scale ranging from 1 (never true) to 5 (always true). Total score was taken into account. IWQOL-long was validated in Mexican population with Cronbach’s $\alpha > .92$ (Bolado, López, González & Comuzzie, 2008), and IWQOL-lite in Colombia with $\alpha > .89$ (Acevedo & Cepeda, 2009). DASS-21 includes three subscales: depression, anxiety, and stress. Participants responded to items using a scale ranging from 0 (never) to 3 (almost always). A composite score was calculated. DASS-21 was validated with Mexican sample with Cronbach’s $\alpha = .86$ (Gurrola, Balcázar, Bonilla & Virseda, 2006). Further analysis was run with the index derived from both questionnaires.

Procedure

All measures were administered at three time-points: base line, 6 and 12 weeks. At the first session all the baseline levels of the variables were obtained, then an educational intervention was applied. Participants were shown, individually a 30-minute video with guidance on exercising, and an encouragement to engage in 30 minutes of exercise daily. The video also included some guidelines on healthy eating based on Sistema Mexicano de Alimentos Equivalentes (SMAE; Pérez, Palacios, Castro & Flores, 2014). Participants were provided with a written guide that included the same content as shown in the video, and the physical exercise and calorie intake forms. Participants were instructed to fill in the forms on three consecutive days, including one weekend-day, prior to each appointment. During the following sessions the reports were reviewed one-on-one, providing feedback to the participants. All participants signed the informed consent form. The study procedure was approved by the Research and Ethics Commissions of the Faculty of Medicine at National Autonomous University of Mexico.

Statistical Analysis

To test the HAPA model we followed the recommendation of Ployhart & Vandenberg (2010), who as various other scholars (Maxwell & Cole, 2007) recommend to evaluate the dynamic relationships between variables. To capture the dynamic change in behavior over time we calculated unstandardized residualized change scores.

Data were analyzed with SPSS AMOS v.23 applying covariant based structural equation modelling (CB-SEM), ordinary least squares analysis, as a better suiting option for structural equation modeling compared to partial least squares (Rönkkö, Mcintosh, Antonakis & Edwards, 2016). First unstandardized residualized change scores (URCS) were calculated for each variable of the HAPA model, and for the three outcome variables and for physical exercise behavior, by regressing the last measure of a variable, at week 12 on its two previous measures: at baseline and week-6. Then these were applied in CB-SME. The URCS controlled for participants' age, education, and gender.

To determine the minimum sample size power tables (Cohen, 1992) were applied, setting alpha at .05, statistical power at .80 and applying the test of multiple regression with seven predictor variables. Based on previous studies we expected a medium to large effect size, e.g. findings from 94 independent tests conducted by Gollwitzer & Sheeran (2006) showed that implementation intentions had a positive effect of d = .65 on goal attainment. According to interpretative guidelines, .2, .5 and .8 are cut-off values for a small, medium and large effect size respectively (Cohen, 1988). Based on alpha .05, statistical power .80, and assuming large effect size, according to the Cohen's tables an estimated sample size of 48 participants was considered adequate for the current study.

To analyze model fit the goodness-of-fit indices were applied: overall goodness of fit test $\chi 2$ (chi-square), CMIN/DF as a parameter sensitive to the sample size, with the value < 3 indicating good fit, CFI (Comparative Fit Index), NFI (Normed Fit Index), GFI (Goodness of Fit Index) with the values > .90 (CFI > .95) indicating good fit; and SRMR (Standarized Root Mean Square Residual) and RMSEA (Root Mean Square of Aproximation) with the values < .05 and < .08, respectively indicating good fit (Hu & Bentler, 1999). To determine the effect sizes of the paths (direct and indirect) for the model testing the determination coefficient R^2, corresponding to the explained variance, was calculated.

Results

Descriptive data for the instruments applied and correlations are presented in Table 1 for all three appointments.

The CB-SEM did not exhibit adequate model fit with the data based on multiple indices, the recommended cut-offs were not met in case of: CFI = .782, NFI = .471, GFI = .858, SRMR = .111. The cut off points were reached for RAMSEA=.066, $\chi 2$=41.16 and CMIN/DF= 1.21 what is insufficient to indicate model´s large explanatory power. Figure 2 depicts standardized path coefficients and R^2 statistics in structural equation model of effects proposed in the Health Action Process Approach model.

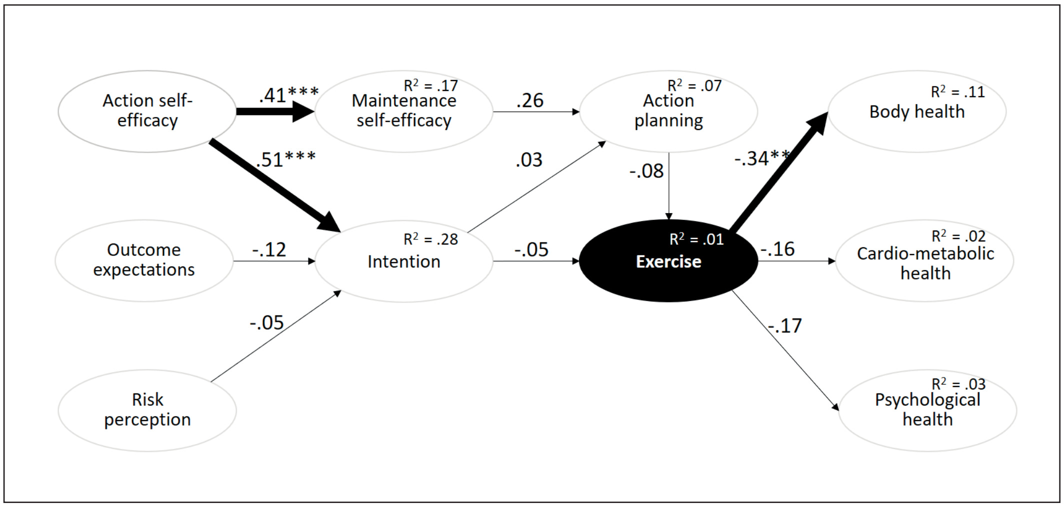

Figure 2. Standardized path coefficients and R^2 statistics in structural equation model of effects proposed according to the Health Action Process Approach.

Note. All variables are unstandardized residualized change scores calculated by regressing each variable at week 12 on the measure of the same variable at baseline and week-6 measures. **p < .01; *** < .001 significant relations are also indicated with bolder arrows.

Table 1.
Means, Standard Deviations, and Correlations for the model variables at baseline, week 6 and 12.

Baseline	M	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12
1. Risk perception	3.56	1.07	1	5												
2. Outcome expectancies	4.75	.48	2	5												
3. Action self-efficacy	4.64	.53	3	5												
4. Intention	4.87	.28	4	5			**.631****									
5. Maintenance Self Efficacy	3.72	.96	2	5			**.379****	**.330***								
6. Action Planning	4.16	.98	1	5	**-.283***	-.219	**.304***	.225								
7. Exercise hours	2.82	2.88	0	11	**-.437****					**.351***						
8. Weight kg	77.12	15.65	56	115	**.491****				-.229		-.193					
9. Fat	40.13	7.51	22	54	.205					.258	-.278					
10. Triglicerides	142.52	75.23	62	470	.268						.213	.272	-.211			
11. LDL	122.32	31.94	59	211					**.327***	-.225	-.220			**.391****		
12. Depresion, Anxiety, Stress DASS	.71	.51	0	2	**.326***					-.231						
13. Qulity of life (IWQOL)	1.74	.57	1	3	**.444****							.246	.253			**.467****
Week 6																
1. Risk perception	3.23	1.02	1	5												
2. Outcome expectancies	4.65	.72	2	5												
3. Action self-efficacy	4.34	.74	2	5	-,206	**.420****										
4. Intention	4.58	.72	3	5	-,203	**.475****	**.745****									
5. Maintenance Self Efficacy	3.87	.76	2	5		**.296***	**.369****	**.303***								
6. Action Planning	4.10	1.05	1	5	**-.301***		**.576****	**.435****	.220							

Continúa

Continuación

Baseline	M	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12
7. Exercise hours	5.14	3.97	0	17	**-.399****	**.282***	**.507****	**.384****		**.552****						
8. Weight kg	75.88	15.33	53	114	**.462****				-.207	-.207						
9. Fat	39.44	7.64	20	55												
10. Triglicerides	145.04	83.33	60	400	**.323***	-.267		-.145	-.231	-.211		**.434****				
11. LDL	119.15	32.35	54	213						-.263	**-.401****					
12. Depresion, Anxiety, Stress DASS	.65	.48	0	2	.223	-.212	-.200	**-.447****								
13. Qulity of life (IWQOL)	1.63	.52	1	3	**.317***			-.247				.276	**.326***			**.454****
Week 12																
1. Risk perception	3.28	1.11	1	5												
2. Outcome expectancies	4.71	.54	2	5												
3. Action self-efficacy	4.32	.73	2	5												
4. Intention	4.61	.60	3	5			**.691****									
5. Maintenance Self Efficacy	3.81	.87	1	5			**.498****	**.532****								
6. Action Planning	3.96	.97	2	5	-.246		**.640****	**.464****	**.368****							
7. Exercise hours	4.41	3.67	0	16	-.224		.219			.274						
8. Weight kg	75.51	15.52	52	113	**.534****					-.239						
9. Fat	39.30	7.34	20	54					**-.290***							
10. Triglicerides	131.50	86.42	409	306	**.340***							**.294***				
11. LDL	116.89	34.57	60	242					**.361***					**.422****		
12. Depresion, Anxiety, Stress DASS	.57	.49	0	2	.228								.232			
13. Qulity of life (IWQOL)	1.53	.49	1	3	**.371****							.262	**.337***			**.347***

Note. p * < .05, ** < .01, *** <.001; only correlations with the value >.2 are shown for legibility.

The statistically significant direct effects were found in case of: (1) changes in action self-efficacy on changes in intention ($b = .51$, $p < .001$); (2) changes in action self-efficacy on changes in maintenance self-efficacy ($b = .41$, $p = .002$), (3) changes in exercising on changes in body health index ($b = -.16$, $p = .012$). The negative beta value indicated that participants that increased their exercising time, decreased their weight-fat index. Changes in maintenance self-efficacy on changes in action planning were close to being significant $b = .26$, $p = .066$. Other hypothesized direct effects and indirect effects were not found statistically significant.

Discussion

We tested relationships between the HAPA model variables for predicting physical exercising and the effect of exercising on body health, cardio-metabolic health and perceived mental health in the sample of Mexican adults at cardio-metabolic risk who wanted to lose weight. The CB-SEM did not exhibit adequate model fit with the data. Three hypothesized relationships were found to be significant: (1) action self-efficacy effect on intention, (2) action self-efficacy effect on maintenance self-efficacy, and the relationship that goes beyond the model (3) exercise effect on body health (weight-fat index).

Regarding the motivational phase, action self-efficacy was found to be a significant predictor of intentions, explaining 24% of its variance. This finding implies that the participants' belief in their capabilities, prior to initiating action, influenced whether or not they formed an intention to exercise.

Contrary to the model, neither outcome expectations nor risk perception were found to be a significant predictor of intentions in the sample. Schwarzer (2008) indicates that expecting positive outcomes, (e.g. If I exercise 30 minutes every day, I will lose weight), together with action self-efficacy, play an important part in the motivational phase, when one weighs the pros and cons of the behavioral result. While the idea that positive outcome expectations guide formation of intention to exercise appears to apply to other tested populations, this did not apply to the Mexican sample. The lack of relationship between risk perception and intention has been found in prior studies (Luszczynska & Schwarzer, 2003; Barg et al., 2012; Parschau et al., 2014; Hattar et al. 2016). Schwarzer (2008) suggests that risk perception may be a variable that plays role when the realization of behavior is considered, prior to forming an intention. In fact, once the intention is formed it may cease to be relevant (Luszczynska & Schwarzer, 2003).

Contrary to the model, in the analyzed sample, intentions did not affect physical exercise behavior. Intentions have been previously proven to be a good predictor of behavior, yet some studies with Mexican samples indicated its limited predictive value, and suggest that confidence in the intention, the degree to which a person is committed to realize a certain behavior, is a more reliable measure (Saldívar-Garduño, 2009). Other, culture dependent aspects may also play a role. For example, overconfidence and optimism bias may explain high scores on intention and their lack of effect on changes in behavior. One study reported that Mexicans display more overconfidence compared to U.S. Americans (Lechuga & Wiebe, 2011). Other studies point out to the cultural differences in unrealistic bias (Joshi & Carter, 2013), in which Mexican participants occupy the fourth place in the ranking of the most optimistic countries (Gallup, 2019). Furthermore, a study on socially desirable responding, points out that Latino respondents scored significantly higher than Anglos on some socially desirable responding indicators (Hopwood, Flato, Ambwani, Garland & Morey, 2009).

Regarding the volitional component, in line with previous research action self-efficacy, we found that participants' confidence that they would be able to deal with barriers that they may face while engaging in exercising, explained 17% of the self-efficacy variance. In addition, maintenance self-efficacy was a marginally significant predictor of action planning ($b = .26$, $p = .066$), explaining 7% of its variance. However, the hypothesis that action planning would affect behavior was not supported. Earlier studies that have applied the HAPA constructs point out to the difference in action planning scores based on the context in which the behavior is performed. Higher scores were noted in a clinical population attending scheduled rehabilitation appointments (2.90–3.57 out of 4, or 3.13–3.24 out of 4; Lippke, Ziegelmann & Schwarzer, 2004; Sniehotta, Scholz &

Schwarzer, 2005) vs. scores obtained for leisure time non-prescribed exercise (inactive women: 3.01 out of 5; Barg et al., 2012). Scheduled rehabilitation sessions may capture the idea of planning via predefined time and place, while leisure time activity may be unstructured and loosely planned (Schwarzer, 2008). In our population, the planning scores were high (4.16, 4.10, 3.96 out of 5, at sessions 1, 2, & 3 respectively) and significantly correlated with exercise ($r = 351$, $p = .012$; $r = 552$, $p < .01$; $r = 27$, $p = .054$, at sessions 1, 2, & 3 respectively). Yet, taking the dynamic relationship of the variables into account, the change in planning was not predictive of a change in behavior.

Although participants considered having planned their actions, plans' quality may have been limited to initiating the action, without considering the complexity of the process: identifying the sub-goals required to get to the main goal, phasing out these sub-goals, recognizing and overcoming barriers as they occur (Allain et al., 2005). Although scores suggest that participants indicated that they had planned, it is possible that the planning process was in fact faulty planning. This leads us to consider the planning process itself in future studies, based on the work of Kahneman, Gilovich, Griffin. (2002), the difference between a logical and intuitive orientation can be explored

Although earlier studies have shown beneficial effects of action planning in various health-behavior domains (cervical cancer diagnostic screening (Sheeran & Orbell, 2000), breast self-examination (Luszczynska & Schwarzer, 2003), reduced intake of high-fat foods (Armitage, 2004), and increased physical exercise (Milne, Orbell & Sheeran, 2002; Sniehotta, Schwarzer, Scholz & Schüz, 2005), various more recent studies have not corroborated this relationship. Hattar et al. (2016) in a study with overweight Australians, did not corroborate the effect of change in action planning on change in physical activity. Similarly, that relationship was not corroborated by Barg et al. (2012) in a sample of North American inactive middle-aged women, nor by Parschau et al. (2014) with the population of German obese adults.

Methodological and cultural differences need to be considered while evaluating the relationships in HAPA. Ployhart &Vandenberg (2010) indicate that different results can be obtained if the models predictive power is evaluated with cross sectional vs. longitudinal data. Studies described in this text that applied the HAPA model encompass both cross sectional and longitudinal approaches. Even within longitudinal designs methodological differences can be found, as some apply difference scores, others residualized change scores. Unlike the former, the later account for initial status differences, that can also contribute to differences in results obtained.

Some limitations of the study need to be mentioned. First, although most of the internal consistency indices of the measures applied to evaluate the variables of the HAPA model showed adequate values, there were some exceptions. For that reason, the adaptation of the instruments to the Mexican population needs to be reviewed to improve its psychometric quality and, consequently, increase the precision of the estimates of the indices in the model by reducing the measurement error. Second, physical activity and psychological data were self-reported and participants completed an array of questionnaires which may have added to a questionnaire burden. Moreover, the results cannot be generalized to broader populations. We acknowledge the relatively small sample size, also affected by the attrition rate, yet at the same time the longitudinal character of the study allowed to test the dynamic relationships between variables, encompassing the longitudinal nature of the HAPA model. Moreover, it has been suggested that the use of small samples in SEM can lead to imprecise estimates of the fit indices and standard errors (Cea, 2002; Kline, 2011). Further studies are required with bigger samples to overcome the mentioned limitations. Also testing the model with populations beyond WEIRD cultures could be beneficial to better understand the key variables that influence changes in physical exercise, that would be of most interest in innervations motivating the behavioral change.

Conclusions

The study corroborated the effect of the physical exercise on body health, meaning increasing time dedicated to exercising was associated with lowering weight and fat levels, yet regarding the relationships between the HAPA model variables, the current results corroborated only some of these relationships in the sample of Mexican adults at cardiometabolic risk who wanted to lose weight. Further investigation is needed in the cultures that go beyond WEIRD to identify variables that influence changes in physical exercise and could be most useful in health behavior interventions.

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