Factorial Structure of the Self-Report of Barriers for Practice of Physical Exercise Among Mexican Non Athlete University Students

José René Blanco Ornelas (Dr.)
Juan Francisco Aguirre Chávez (Dr.)
Susana Ivonne Aguirre Vásquez (Dr.)
Elia Verónica Benavides Pando (Dr.)
Perla Jannet Jurado García (Dr.)
Autonomous University of Chihuahua, Mexico

Doi:10.19044/esj.2018.v14n20p77 URL:http://dx.doi.org/10.19044/esj.2018.v14n20p77

Abstract

The present study intends to investigate if the psychometric results proposed by Niñerola, Capdevila and Pintanel (2006) for the Self-report of Barriers for Practice Physical Exercise (ABPEF) in Mexican university students are replicated. A total of 877 university students (mean age = 20.8 ± 2.5 years) participated. The factorial structure of the questionnaire was analyzed through confirmatory factorial analyzis, which showed that a four factor structure is feasible and adequate. The four factors (body image, fatigue, obligations and environment), according to statistical and substantive criteria, have shown adequate fit indicators of reliability and validity, which correspond to the structure proposed for the original questionnaire. In addition, the results of the factorial analyzis carried out with the subsamples, indicate the existence of strong evidence of the stability of the factorial structure. Further research should replicate these findings in larger samples.

Keywords: Instrumental study; factorial structure; construct validation; factorial invariance

Introduction:

In today's society physical activity (FA) is assumed as an essential variable in the health of people (Division of Nutrition Physical Activity and Obesity National Center for Chronic Disease Prevention and Health Promotion, 2018; Reiner, Niermann, Jekauc & Wol, 2013). In addition, healthy habits acquired at an early age are key to achieve and maintain an optimal health throughout life (Longmuiremail, Colley, Wherley & Tremblay, 2014). However, there are numerous findings regarding physical inactivity and the consequent difficulty in acquiring active lifestyles in young people (Cuenca-García, et al., 2014; Meneses & Ruiz, 2017). Due to this evidence, the fight against sedentarism and the increase of the FA among young people is a major public health challenge and a scientific priority (Gillis, et al., 2013). Studies with adult populations have shown that levels are even lower than at school ages (Cocca, Liukkonen, Mayorga-Vega & Viciana, 2014; Meneses & Ruiz, 2017; Reiner, et al., 2013), due to the previously mentioned reduction of motivation throughout life and the longitudinal effects of impact in adulthood (Zimmermann-Sloutskis, Wanner, Zimmermann & Martin, 2010).

The Increasing of a sedentary life in society is a concern to the scientific community and to health professionals, as it increases the cause of mortality by 20-30% (World Health Organization, 2011) and causes enormous economic losses. For example, the Eurydice Report of the European Commission establishes 80% of European children as FA practitioners only in school, and they do not compensate outside of school (European Commission / EACEA / Eurydice, 2013). This sedentary lifestyle entails billions of euros of direct and indirect costs to society (International Sport and Culture Association, 2015).

The barriers perceived by the population for the realization of FA, therefore, acquire enormous importance and contribute the crucial factors to increase the realized FA. Among these barriers, previous literature has shown that lack of time (Steptoe, et al., 2002), social influence linked to body image and other socioeconomic factors (Bibiloni, Pich, Córdova, Pons & Tur, 2012; Herazo-Beltrán et al., 2017), or the lack of resources (Serrano-Sanchez, et al., 2011), among others, are different barriers identified as causing the level of sedentarism in different populations (Al-Kubaisy, Mohamad, Ismail, Abdullah & Mokhtar, 2015).

Regarding to the measuring instruments of these barriers we find some applied mainly in the American population, such as the San Diego Health and Exercise Questionnaire (Rauh, Hovell, Hofstetter, Sallis & Gleghorn, 1992) or Barriers to Being Active Quiz Of Human Services, 1999), of 16 and 21 items, respectively, focused on the barriers of realization of FA. However, the most important contribution in the Spanish language is the Self-report of Barriers for practice Physical Exercise (ABPEF) by (Capdevila, 2005) and later validated by Niñerola et al. (2006). It consists of 4 factors: (a) Image (related to physical anxiety and concern about how others see us in the practice of FA); (B) Motivation (related to personal motives such as willpower to do FA); (C) Condition (related to physical condition as a barrier to the practice of FA); And (d) Organization (related to the time and resources available for the realization of FA).

However, specifically in the Mexican population, we did not find previous instruments to support research on barriers to the practice of FA. The importance of proving the factorial structure of an instrument and the psychometric equivalence of it in different population justifies this research (Abalo, Lévy, Rial & Varela, 2006). Consequently, the objective of the present instrumental study (Montero & León, 2005) was to verify the factorial structure of the ABPEF and its psychometric equivalence in non athlete Mexican university students.

- **Method:**
- **Participants**

The sample of 877 university students 300 men and 577 women, was obtained by a convenience sample, trying to cover the representativeness of the different degrees of the Faculty of Physical Culture Sciences of the Autonomous University of Chihuahua. The participants' ages ranged from 18 to 36 years (mean = 20.8 ± 2.5 years). The sample was randomly divided into two parts using the Statistical Package for the Social Sciences (SPSS) in version 18.0; In order to carry out parallel studies that allowed corroborating and verifying the results obtained (cross-validation). Subsample 1 consisted of 451 subjects. The ages ranged from 18 to 33 years, with a mean of 20.9 and a standard deviation of 2.6 years. Sub-sample 2 was composed of 426 subjects. The ages ranged from 18 to 36 years, with a mean of 20.6 and a standard deviation of 2.4 years.

- **Measure**

The ABPEF of Niñerola et al. (2006) consists of 17 items, which is to be respoded according to a Likert scale of 0 to 10 points, where values close to 0 indicate "an unlikely reason that prevents me from exercising in the next few weeks", and values close to 10 indicate a "very likely reason that prevents me from practicing physical exercise." For our study, two adaptations were made to the version of Niñerola et al. (2006): (a) the first one was to change some terms used in the items of the original version in order to use a language more appropriate to the context of Mexican culture; (B) the second consisted in applying the instrument by means of a computer (figure 1), thus allowing the storage of the data without previous coding, with greater accuracy and avoiding errors.

- **Procedure**

Students of the degrees offered at the Faculty of Physical Culture of the Autonomous University of Chihuahua were invited to participate. Those who agreed to participate signed the consent letter. Then, the instrument described above was applied in the laboratories of the mentioned Faculty by means of a personal computer (manager module of the instrument of the editor of typical scales of execution), in a session of approximately 30 minutes. At the beginning of each session students were given a brief introduction on the importance of the study and how to access the instrument; they were asked the utmost sincerity and they were guaranteed the confidentiality of the data obtained. Instructions on how to respond were in the first screens; before the first instrument item. At the end of the session they were thanked for their participation. Finally, the results were compiled using the results generator module of the scale editor, version 2.0 (Blanco, et al., 2013).

- **Data Analysis**

The first step in the analysis of the psychometric properties of the questionnaire was to calculate the mean, standard deviations, asymmetry, kurtosis and discrimination indexes for each item; to then eliminate from the scale those that obtain kurtosis or extreme asymmetry or a discrimination index below .35.

Then, two measurement models were compared: the ABPEF-4, which responds to a four factor structure according to the original distribution of the items in the questionnaire and the ABPEF-4b that responds to the factorial structure of the previous model, eliminating the items that were not sufficiently explained by that model.

Lastly, a factor invariance analysis of the better model obtained was conducted, following the recommendations of Abalo et al. (2006), the reliability of each of the dimensions was calculated using the Cronbach's alpha (Elosua y Zumbo, 2008; Nunnally & Bernstein, 1995) and the omega coefficient Omega (Revelle & Zinbarg, 2009; Sijtsma, 2009).

A confirmatory factor analysis was conducted for the first sub-sample using the software AMOS 21 (Arbuckle, 2012). The error variances were specified as free parameters. In each latent variable (factor) one of the structural coefficients associated was fixed to the value of one in order to make its scale equal to one of the observed variables (items). The maximum likelihood estimation method, following Thompson's (2004) recommendations, was conducted to compare the fit indices of several alternative models to select the best one.

In the fit model assessment, the chi-squared test, the adjusted goodness of fit index (GFI), and the root mean square error of approximation (RMSEA) were used as absolute fit indices. The adjusted goodness-of-fit index (AGFI), the Tucker-Lewis index (TLI) and the comparative fit index (CFI) were used as incremental fit indices. Chi-squared divided by degrees of freedom (CMIN/df), and the Akaike information criterion (AIC) were used as parsimony fit indices (Byrne, 2010; Gelabert, et al., 2011).

- **Results:**

Descriptive Analysis and Discrimination indexes

- Responses to all items in the total sample reflect mean scores ranging from 0.98 to 4.85, and the standard deviation in all cases is greater than 1.8 (within a range of responses between 0 and 10). Most values of asymmetry and kurtosis are within the range ± 2.0 and ± 3.0, respectively, so it is inferred that the variables are reasonably adjusted to a normal distribution. Regarding discrimination indexes, all items satisfactorily discriminated with indexes above .40 (Brzoska & Razum, 2010).

Confirmatory factor analysis

The Global results of the confirmatory factor analysis in sub-sample 1 (GFI .855, RMSEA .099; CFI .856) and subsample 2 (GFI .893; RMSEA .080; CFI .904) for the ABPEF-4 model corresponding to a structure of four factors according to the original distribution of the items within the questionnaire, indicated that the measurement model was not acceptable (Table 1).

Table 1. Absolute, incremental and Parsimony fit indexes for the generated models. Subsamples 1 and 2

* $p < .05$; GFI = goodness-of-fit index; RMSEA = root mean square error of approximation; AGFI = adjusted goodness-of-fit index; TLI = Tucker-Lewis index; CFI = comparative fit index; CMIN/df = chi-squared fit index divided by degrees of freedom; AIC = Akaike information criterion

	Absolute Fit indexes			Incremental Fit indexes			Parsimony Fit indexes	
Model	χ^2	GFI	RMSEA	AGFI	TLI	CFI	CMIN/DF	AIC
First Factor Solution (subsample 1)								
ABPEF-4	611.215*	.855	.099	.804	.827	.856	5.409	691.215
ABPEF-4b	167.062*	.942	.070	.898	.938	.959	3.213	245.062
Second Factor Solution (subsample 2)								
ABPEF-4	422.916*	.893	.080	.855	.885	.904	3.743	502.916
ABPEF-4b	171.520*	.940	.074	.895	.931	.954	3.298	249.520

The four factors of the ABPEF-4 model, both subsamples, explained approximately 63% of the variance. On the other hand, seven of the 17 items in the first subsample saturated below .70 in their predicted dimension (items 1, 2, 5, 7, 9, 14 and 17) and eight in the second subsample (items 1, 2, 5, 7, 8, 14, 15 and 17). In addition, moderate intercorrelations were among the four factors, evidencing adequate discriminant validity between them.

The global results of confirmatory factor analysis in the first (GFI .942; RMSEA .070, CFI .959) and second subsample (GFI .940; RMSEA .074, CFI .954), of the second model tested (ABPEF-4b) that responds to the factorial structure of the previous model (ABPEF-4), eliminating items 1, 2, 5 and 14 that were not sufficiently well explained, indicated that the ABPEF-4b measurement model was better than the previous model and that their fit was acceptable (Table 1). The four factors of this model explained, in both subsamples, approximately 71% of the variance.

On the other hand, according to the results of Table 2, only three of the 13 items, in both subsamples, saturated below .70 in their predicted dimension (items 9, 12 and 17). Moderate intercorrelations were observed among the four factors, showing an adequate discriminant validity among them.

- *Invariance of the factor structure between subsamples*

The fit indexes obtained (Table 3) allow to accept the equivalence of the basic measuring models between the two subsamples. Although the value of Chi-squared exceeds the required to accept the hypothesis of invariance, the GFI=.941, CFI=.957, RMSEA=.051 y AIC=484.582 indexes contradict this conclusion allowing us to accept the base model invariance (unrestricted model).

Adding to the base model restrictions on factorial loads the metric invariance was characterized. The values shown in Table 3 allow to accept this level of invariance. The goodness of fit index (GFI .935) and root mean square error of approximation (RMSEA .051) continue to provide convergent information in this direction. Also, the Akaike Information Criterion (AIC 511.573) and Bentler comparative fit index (CFI .952) do not suffer large variations over the previous model. Using the criteria for the evaluation of the nested models proposed by Cheung and Rensvold (2002), who suggest that if the calculation of the difference of the CFI of both nested models diminish in .01 or less, the restricted model is taken for granted therefore the compliance of the factorial invariance. The difference of the CFIs obtained allows to accept the metrical invariance model. We can conclude up to this point that factorial loads are equivalent in the two subsamples.

Table 2. Standardized solutions for the confirmatory factor analysis in both subsamples F1 = Body Image / social physical anxiety F2 = Fatigue / Laziness F3 = Obligations / Lack of time F4 = Environment / Facilities

	Subsample 1				Subsample 2			
Item	F1	F2	F3	F4	F1	F2	F3	F4
Factor Loading								
3. Feeling discomfort about the appearance I have with sportswear	.72				.75			
6. Feeling that my physical appearance is worse than that of others	.87				.83			
10. To think that other people are in better shape than I am	.84				.80			
13. Thinking that others judge my physical appearance	.78				.89			

16. Feel ashamed because they are watching me while I exercise	.70				.73			
8. Not being "in shape" to exercise		.83				.74		
9. Lack of will to be constant		.60				.65		
12. Note tiredness or fatigue regularly throughout the day		.59				.63		
4. Having too much work			.73				.73	
7. Having too many family obligations			.58				.70	
11. Not find time for exercise			.82				.75	
15. Finding myself disgusted with people who exercise with me				.87				.78
17. The facilities or the coaches are not suitable				.47				.40
Factor Correlation Matrix								
F1	-				-			
F2	.85	-			.76	-		
F3	.40	.54	-		.41	.68	-	
F4	.75	.66	.26	-	.73	.63	.42	-

Having demonstrated the metric invariance between the subsamples, we evaluate the equivalence between intercepts (strong factorial invariance). The Indexes (Table 3) show a good adjustment of this model, evaluated independent as well as analyzed toward nesting with the metric invariance model. The difference between the two comparative indices of Bentler is .002; and the general fit index is .933 and the root mean square error of approximation is .050. Accepted then the strong invariance, the two evaluated models are equivalent toward the factorial coefficients and the intercepts.

Table 3. Goodness of fit indexes of each of the models tested in the factorial invariance

* p < .05; GFI = goodness-of-fit index; NFI = normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; AIC = Akaike information criterion

Model	Fit indexes						
	χ2	gl	GFI	NFI	CFI	RMSEA	AIC
Model without restrictions	338.582*	104	.941	.939	.957	.051	484.582
Metric Invariance	373.573*	113	.935	.933	.952	.051	511.573
Strong factor invariance	392.270*	123	.933	.929	.950	.050	510.270

The factors obtained in the confirmatory factor analysis, mostly all reached values above .70 of internal consistency in both samples; demonstrating adequate internal consistency for these type of subscales, particularly if it is considered the small number of items (Table 4).

Table 4. Omega and alpha coefficient for the factors obtained

	Subsample 1		Subsamble 2	
Factor	Ω	□	Ω	□
Body Image / social physical anxiety	.888	.881	.900	.896
Fatigue / Laziness	.718	.720	.714	.718
Obligations / Lack of time	.757	.769	.771	.769
Environment / Facilities	.637	.586	.531	.531

- **Discussion:**

The main objective of the study was to investigate whether or not the psychometric results proposed by Niñerola et al. (2006) replicate, for the Self-Report of "Barriers to Practice Physical Exercise" through a sample of Mexican university students using Confirmatory Factor Analysis (CFA).

Confirmatory factorial analyzes support the factorial structure of four factors: (body image, fatigue, obligations and environment) obtained by Niñerola et al. (2006) as evidencing an adequate internal consistency, particularly considering the reduced number of items in each of them. At the same time, the factors thus obtained presented, in general, adequate standardized factorial saturations, which correspond to the structure proposed for the original questionnaire, except for the elimination of items 1, 2, 5 and 14.

On the other hand, the results of the analysis of factorial invariance between the subsamples studied indicated a high congruence between pairs of factors. This suggests the existence of strong evidence of the cross-validation of the measure and therefore of the stability of the structure, until it is proved otherwise.

In summary, the analysis of the psychometric properties of the questionnaire has shown that a four factor structure is feasible and adequate according to the psychometric requirements established when the informants are the teachers themselves.

- **Conclusion:**

The structure of four factors, based on statistical and substantive criteria, has shown adequate indicators of adjustment, reliability and validity. However, the scope of these results is limited, and it is necessary for future research to confirm the structure obtained, which will allow for more robust evidence regarding the factorial structure of the scale. Specifically, it must be demonstrated whether the invariance of the scale structure is met by gender and age, among others. It is therefore considered that more studies are necessary in order to corroborate or refute the data obtained in the investigations carried out so far. It is also essential to check whether the questionnaire is useful to explain the lack of motivation and adherence to the beginning and maintenance of active behavior.

- **Acknowledgment:**

Mexican Ministry of Education-Department of Higher Education-General Directorate of the University Education (DE-13 -6894) financed this study.

References:

1. Abalo, J., Lévy, J., Rial, A. & Varela, J. (2006). Invarianza factorial con muestras múltiples. En J. Lévy (Ed.), *Modelización con Estructuras de Covarianzas en Ciencias Sociales* (pp. 259-278). Madrid: Netbiblo.
2. Al-Kubaisy, W., Mohamad, M., Ismail, Z., Abdullah, N. N., & Mokhtar, M. M. (2015). Motivation to physical exercise: is it diverse with different sociodemographic characteristics particularly the gender? European Scientific Journal, 2, 193-209.
3. Arbuckle, J. R. (2012). *AMOS users guide version 21.0*. Chicago, IL: Marketing Department, SPSS Incorporated.
4. Bibiloni, M. d. M., Pich, J., Córdova, A., Pons, A. & Tur, J. A. (2012). Association between sedentary behaviour and socioeconomic factors, diet and lifestyle among the Balearic Islands adolescents. *BMC Public Health, 12*(718), pp. 1-11. doi: 10.1186/1471-2458-12-718
5. Blanco, H., Ornelas, M., Tristán, J. L., Cocca, A., Mayorga-Vega, D., López-Walle, J. & Viciana, J. (2013). Editor for creating and applying computerise surveys. *Procedia Social and Behavioral Sciences, 106,* pp. 935-940. doi: http://dx.doi.org/10.1016/j.sbspro.2013.12.105
6. Brzoska, P. y Razum, O. (2010). *Validity Issues in Quantitative Migrant Health Research: The Example of Illness Perceptions*. New York, NY: Peter Lang International Academic Publishers.
7. Byrne, B. M. (2010). *Structural Equation Modeling With AMOS: Basic Concepts, Applications, and Programming*. New York, NY: Routledge.
8. Capdevila, L. (2005). *Actividad física y estilo de vida saludable*. Girona: Documenta Universitaria.
9. Cocca, A., Liukkonen, J., Mayorga-Vega, D. & Viciana, J. (2014). Health-related physical activity levels in Spanish youth and young adults. *Perceptual and motor skills, 118*(1), pp. 247-260.
10. Cuenca-García, M., Ortega, F. B., Ruiz, J. R., González-Gross, M., Labayen, I., Jago, R. … Sjöström, M. (2014). Combined influence of healthy diet and active lifestyle on cardiovascular disease risk factors

in adolescents. *Scandinavian Journal of Medicine and Science in Sports, 24*(3), pp. 553-562. doi: 10.1111/sms.12022

11. Cheung, G. W. & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), pp. 233-255. doi: 10.1207/s15328007SEM0902_5
12. Division of Nutrition Physical Activity and Obesity National Center for Chronic Disease Prevention and Health Promotion. (2018). Physical Activity and Healt. https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm
13. Elosua, P. & Zumbo, B. D. (2008). Coeficientes de fiabilidad para escalas de respuesta categórica ordenadas. *Psicothema, 20*(4), pp. 896-901.
14. European Commission/EACEA/Eurydice. (2013). Physical education and sport at school in Europe Eurydice Report. Luxembourg:: Publications Office of the European Union.
15. Gelabert, E., García-Esteve, L., Martín-Santos, R., Gutiérrez, F., Torres, A. & Subirà, S. (2011). Psychometric properties of the Spanish version of the Frost Multidimensional Perfectionism Scale in women. *Psicothema, 23*(1), pp. 133-139.
16. Gillis, L., Tomkinson, G., Olds, T., Moreira, C., Christie, C., Nigg, C… Willem, V. M. (2013). Research priorities for child and adolescent physical activity and sedentary behaviours: an international perspective using a twin-panel Delphi procedure. *International Jorunal of Behavioral Nutrition and Physical Activity, 10*(112), pp. 1-8. doi: 10.1186/1479-5868-10-112
17. Herazo-Beltrán, Y., Pinillos, Y., Vidarte, J., Crissien, E., Suarez, D., & García, R. (2017). Predictors of perceived barriers to physical activity in the general adult population: a cross-sectional study. Brazilian journal of physical therapy, 21(1), 44-50. doi: 10.1016/j.bjpt.2016.04.003
18. International Sport and Culture Association. (2015). The economic cost of physical inactivity in Europe: Centre for Economics and Business Research.
19. Longmuiremail, P., Colley, R., Wherley, V. & Tremblay, M. (2014). Risks and benefits of childhood physical activity. *The Lancet Diabets Endocrinologye Psychology, 2*(11), pp. 861-862. doi: 10.1016/S2213-8587(14)70221-9
20. Meneses, M., & Ruiz, F. (2017). Estudio longitudinal de los comportamientos y el nivel de actividad físico-deportiva en el tiempo libre en estudiantes de Costa Rica, México y España (Longitudinal study on leisure time behaviors and physical and sports activity level in students from. Retos(31), 219-226.

21. Montero, I. & León, O. (2005). Sistema de clasificación del método en los informes de investigación en Psicología. *International Journal of Clinical and Health Psychology, 5,* pp. 115-127.
22. Niñerola, J., Capdevila, L. & Pintanel, M. (2006). Barreras percibidas y actividad física: el autoinforme de barreras para la práctica de ejercicio físico. *Revista de Psicología del Deporte, 15*(1), pp. 53-69.
23. Nunnally, J. C. & Bernstein, I. H. (1995). *Teoría Psicométrica*. México: McGraw-Hill.
24. Organización Mundial de la Salud. (2011). Informe sobre a situación mundial de las enfermedades no transmisibles 2010. Ginebra: Organización Mundial de la Salud.
25. Rauh, M. J. D., Hovell, M. F., Hofstetter, C. R., Sallis, J. F. & Gleghorn, A. (1992). Reliability and Validity of Self-Reported Physical Activity in Latinos. *21*(5), pp. 966-977. doi: 10.1093/ije/21.5.966
26. Reiner, M., Niermann, C., Jekauc, D. & Wol, A. (2013). Long-term health benefits of physical activity – a systematic review of longitudinal studies. *BMC Public Health, 13,* pp. 1-9. doi: 10.1186/1471-2458-13-813
27. Revelle, W. & Zinbarg, R. E. (2009). Coefficients alpha, beta, omega and the glb: comments on Sijtsma. *Psychometrika*, *74*(1), pp. 145-154. doi: 10.1007/s11336-008-9102-z
28. Serrano-Sanchez, J. A., Martí-Trujillo, S., Lera-Navarro, A., Dorado-García, C., González-Henríquez, J. J. & Sanchís-Moysi, J. (2011). Associations between Screen Time and Physical Activity among Spanish Adolescents. *Plos One, 6*(9), pp. 1-9. doi: 10.1371/journal.pone.0024453
29. Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of Cronbach’s alpha. *Psychometrika, 74*(1), pp. 107-120. doi: 10.1007/s11336-008-9101-0
30. Steptoe, A., Wardle, J., Cui, W., Bellisle, F., Zotti, A.-M., Baranyai, R. & Sanderman, R. (2002). Trends in Smoking, Diet, Physical Exercise, and Attitudes toward Health in European University Students from 13 Countries, 1990–2000. *Preventive Medicine, 35,* pp. 97-104. doi: 10.1006/pmed.2002.1048
31. Thompson, B. (2004). *Exploratory and Confirmatory Factor Analysis. Understanding concepts and applications.* . Washington, D C: American Psychological Association.
32. United Service Department of Human Services. (1999). *Promoting Physical Activity: A Guide for Community Action*. Champaign, IL: Human Kinetics.

33. Zimmermann-Sloutskis, D., Wanner, M., Zimmermann, E. & Martin, B. W. (2010). Physical activity levels and determinants of change in young adults: a longitudinal panel study. *International Journal of Behavioral Nutrition and Physical Activity, 7*(2), pp. 1-13. doi: 10.1186/1479-5868-7-2