

Adaptation and reproducibility of a questionnaire to evaluate physical activity among the Comcáac (Seri) community of Sonora, Mexico

Adaptación y reproducibilidad de un cuestionario para evaluar la actividad física en la comunidad Comcáac (Seri) de Sonora, México

Marcos Lavandera-Torres*, Julián Esparza-Romero*^o

ABSTRACT

Physical activity questionnaire (PAQ) is the most widely used method for evaluation of physical activity (PA). The aim of this study was to adapt and evaluate reproducibility of a PAQ in Comcáac community of Sonora, Mexico. Adaptation of PAQ was conducted through interviews with key residents. Reproducibility was evaluated applying PAQ twice to 26 persons within 20 or more years old, using Spearman coefficient ρ and intraclass correlation coefficient (ICC). High correlations ($p < 0.05$) were found in total previous-year and previous-week recreational activities ($\rho = 0.82$ and $\rho = 0.76$, respectively). Correlations were equally high for occupational activities group related to craftwork manufacture ($\rho = 0.96$ and $\rho = 0.74$) and fishery activities ($\rho = 0.93$ and $\rho = 0.78$) for previous-year and previous-week, respectively. Adapted PAQ could be a useful tool to evaluate PA pattern in community and can be used in future research on association between PA, obesity and diabetes.

RESUMEN

El cuestionario de actividad física (CAF) es el método más utilizado para evaluar la actividad física (AF). El objetivo de este estudio fue adaptar y evaluar la reproducibilidad del CAF en la comunidad Comcáac (Seri) de Sonora, México. La adaptación del CAF se realizó a través de entrevistas con residentes claves. La reproducibilidad se evaluó aplicando el CAF por duplicado a 26 personas, usando los coeficientes de correlación de Spearman ρ e intraclass (ICC, por sus siglas en inglés). Se encontraron correlaciones altas ($p < 0.05$) en actividades recreativas del año pasado y semana pasada ($\rho = 0.82$ y $\rho = 0.76$, respectivamente). Correlaciones igualmente altas se encontraron en actividades ocupacionales relacionadas con la artesanía ($\rho = 0.96$ y $\rho = 0.74$) y la pesca ($\rho = 0.93$ y $\rho = 0.78$) para el año pasado y la semana pasada, respectivamente. El CAF puede ser una herramienta útil para evaluar la AF en la comunidad y puede ser utilizado en futuras investigaciones sobre la asociación entre AF, obesidad y diabetes.

Recibido: 8 de marzo de 2016
Aceptado: 7 de noviembre de 2016

Keywords:

Physical activity; questionnaire; adaptation; reproducibility; Mexican indigenous.

Palabras clave:

Actividad física; cuestionario; adaptación; reproducibilidad; indígenas mexicanos.

Cómo citar:

Lavandera-Torres, M., & Esparza-Romero, J. (2017). Adaptation and reproducibility of a questionnaire to evaluate physical activity among the Comcáac (Seri) community of Sonora, Mexico. *Acta Universitaria*, 27(1), 76-82. doi: 10.15174/au.2017.1272

INTRODUCTION

Comcáac ethnic group, better known in Mexico as Seri Indians (Alaez *et al.*, 2002), is a non-agricultural group of people that originally lived under a traditional lifestyle. In the past, their food was mainly obtained by fishery with harpoons, complemented with collection of fruit from desert plants and hunting animals. They used to be a semi-nomadic group whose sedentarisation was influenced greatly by establishment of a fishery cooperative in 1939. Nowadays, this group is settled in communities of *Punta Chueca* and *El Desemboque*, located in northwestern Mexico, and has experienced a certain degree of modernization and acculturation; fishery is done using boats with outboard motors and food is mainly obtained from local and surrounding village's shops. Commercial fishery, craft sale and ecotourism and hunting projects are their principal commercial activities (Luque & Robles, 2006; Noriega-Orozco, 2007; Rentería-Valencia, 2007). This changes might be associated to a decrease in physical activity (PA) and consequently, to increasing obesity and diabetes problems (Hu, 2011; Villela & Palinkas, 2000).

* Diabetes Research Unit, Research Center for Food and Development (Unidad de Investigación en Diabetes, Centro de Investigación y Desarrollo, A.C.). Carretera a La Victoria Km. 0.6, Apdo. postal 1735, Hermosillo, Sonora, México, C.P. 83304. Phone: (+52) 662 289 2400; fax: (+52) 662 280 0422. E-mail: julian@ciad.mx

^o Corresponding author.

There is strong evidence that physical inactivity is a risk factor for hypertension, diabetes, heart disease and some types of cancer (Bassett, Wyatt, Thompson, Peters & Hill, 2010; Ono *et al.*, 2007). Furthermore, PA is well known as an important component of a healthy lifestyle to prevent obesity and a variety of chronic diseases (Assah *et al.*, 2011; Hong, Trang, Van der Ploeg, Hardy & Dibley, 2012; Neilson, Robson, Friedenreich & Cszmadi, 2008; Siebeling, Wiebers, Beem, Puhan & Ter Riet, 2012; Tamioka, Iwamoto, Saeki & Okamoto, 2011). According to World Health Organization, almost half of adult population in developing countries, such as Mexico, doesn't perform enough PA to achieve its health benefits (Macfarlane, Chan & Cerin, 2010; Medina, Barquera & Janssen, 2013).

Physical activity questionnaires (PAQ) are the most common methods used to evaluate PA in population studies (Kriska *et al.*, 1990), because of its low cost and practicality (Haskell & Kiernan, 2000; Helmerhorst, Brage, Warren, Besson & Ekelund, 2012; Hong *et al.*, 2012), a greater flexibility in behavioral description of PA patterns and because it can precisely classify people (Assah *et al.*, 2011; Ono *et al.*, 2007).

Precise measurement of PA in epidemiological studies still represents a great challenge in terms of viability and validity (Assah *et al.*, 2011). Since PA recalling is a complex cognitive process that can generate mistakes in interpretation of questions due to cultural differences in activities and terminologies, it is essential to ensure a safe and valid adaptation (Macfarlane *et al.*, 2010).

Some studies have evaluated reproducibility of physical activity questionnaires to ensure they are useful tools in epidemiological studies. Kriska *et al.* (1990) evaluated reproducibility of a PAQ in the U.S. Pima Indian community. Further Nang *et al.* (2011) evaluated reproducibility of two PAQ: International Physical Activity Questionnaire (IPAQ) and Singapore Prospective Study Program Physical Activity Questionnaire (SP2PAQ). Likewise, Bae, Cho & Son (2015), similar to other studies, applied test-retest method using Korean Version of Neighborhood Physical Activity Questionnaire.

Other studies have evaluated physical activity questionnaires reproducibility in Mexican population. Medina *et al.* (2013) evaluated correlation of IPAQ in Mexicans and Mexican-Americans living in United States. Moreover, Vega-López, Chavez, Farr & Ainsworth (2014) evaluated two questionnaires: Stanford

Brief Activity Survey (SBAS) and Rapid Assessment of Physical Activity (RAPA). Since, there is not a PAQ adapted for Seri people, the objectives of this study were to adapt and evaluate reproducibility of a questionnaire to estimate PA patterns, with the purpose of using it to study association of PA with obesity, diabetes, insulin resistance and metabolic syndrome in future investigations in this population.

Subjects

Men and non-pregnant women within 20 or more years old, members of Comcáac community from the State of Sonora, were invited to participate in this study through home visits. They received an explanation of the objectives of the study and were extended the invitation. Protocol was approved by ethics committee of Research Center for Food and Development (*Centro de Investigación en Alimentación y Desarrollo*, A.C.). All participants signed informed consent form.

Methods

Adaptation

Questionnaire used in this study was originally proposed by Kriska *et al.* (1990), which was adapted by Esparza *et al.* (2000) for Pima population of Sonora, Mexico. Questionnaire process of adaptation was carried out using information obtained through 15 interviews to people from Comcáac community (9 women and 6 men) who were invited to participate through a health promoter. Participants were first visited at their home and then interviewed about their leisure (defined as those activities not related with monetary compensation) and occupational activities (defined as those activities related with monetary compensation) performed as part of their daily life. Home activities were also considered as occupational activities (Esparza *et al.*, 2000). All answers and observations were written down in a log book. Afterwards, those activities that were consistent among participants were identified and used for adaptation of questionnaire by including them in PAQ (Esparza *et al.*, 2000). Additionally, an open question that considers any new important activity in their usual physical activity pattern was also considered in PAQ.

Reproducibility

Adapted questionnaire comprises two sections to register activities, one for previous-year and another for previous-week activities. In previous-year section, participants were asked about number of months per

year, average times per month and average hours per time their activities were performed. In previous-week section, proposed questionnaire evaluates PA by enquiring each participant whether previous-year reported activities were also performed during the last previous-week (days per week and hours per day time). Physical activity questionnaires were applied twice, with a margin of 3 – 5 weeks in between each one by properly trained personnel following a pre-established protocol calling test-retest method (Chun, 2012; Craig *et al.*, 2003; Kriska *et al.*, 1990).

Statistical analysis

To evaluate reproducibility of adapted PAQ, activities obtained from the two questionnaires were analyzed using Spearman coefficient ρ and intraclass correlation coefficient ICC, for both previous-year and previous-week sections of questionnaires. Evaluated variables were analyzed as hours-per-week and metabolic equivalents-hour-week (METs) either as total leisure and occupational activities or as group of activities (leisure activities: sport; occupational activities: home related, craftwork manufacture related, fishery related).

RESULTS

Subjects

Questionnaire was initially applied to 35 subjects (17 women and 18 men). Home visits were carried out with assistance of community's health promoter. However, due to reasons external to the study, only 26 participants, 11 men and 15 women, completed their second PAQ after 3 to 5 weeks apart from first application. Time to complete PAQ interview took approximately 30 min.

Average age was 38.2 years, with a minimum of 20.6 years and maximum of 60.9 years. Anthropometric characteristics such as weight, height, body mass index (BMI) and waist circumference are shown by sex in table 1.

Adaptation

Leisure activities such as watching television, attending church, walking or practicing sports, among others, as well as occupational activities related to craftwork manufacture and fishery activities were identified during process of adaptation. Regarding home activities,

we found cooking, sweeping and mopping the floor, doing dishes, and laundry. List of activities by category (leisure or occupational) is shown in table 2. In addition to home related activities, two main groups of occupational activities were identified: *a)* those related to craftwork manufacture, which includes activities related to production of limberbush baskets, bracelets and necklaces, and figure carvings made of ironwood or stone; *b)* those groups related to fishery activities, mainly pen shell, crab and fish.

Table 1.
Anthropometric characteristics of participants by sex.

	Men (n = 11)	Women (n = 15)
Age (year)	38.3 ± 8.6	38.2 ± 10.6
Weight (kg)	80.6 ± 13.9	66.5 ± 10.1
Height (cm)	176.4 ± 4.7	162.4 ± 7.4
BMI (kg/m ²)	25.8 ± 3.6	25.4 ± 5.2
Waist circumference (cm)	89.3 ± 8.2	88.1 ± 11.5

Data shown as mean ± SD.
Source: Author's own elaboration.

Table 2.
Lists of leisure and occupational groups of activities.

Activities (METs)		
Sports group –leisure	Washing by hand (4.00)	Counter (1.50)
Walking (3.80)	Sweeping the floor (4.00)	Arranging product (1.80)
Jogging (6.50)	Mopping the floor (4.00)	Carrying boxes (2.00)
Soccer (7.00)	Watering plants (1.50)	Fishery group
Other activities	Wood cutting (6.50)	Pen shell fishery (12.00)*
Watching television (1.30)	Cleaning the bathroom (2.50)	Crab fishery (4.00)
Attending church (1.80)	Craftwork group	Net fishery (4.30)
Hunting (6.50)	Limberbush baskets (2.00)	Other activities
Driving (2.80)	Necklaces and bracelets (1.80)	Student (1.30)
Home group – occupational	Carving of figure (3.00)	Monitor wildlife (5.30)
Cooking (2.80)	Hand sewing (1.80)	Hunting guide (5.30)
Washing dishes (2.50)	Store group	Musician (2.00)

METs: metabolic equivalents. *Diving.
Source: Author's own elaboration.

Table 3.
Correlation for total hours/week between the first and the second PAQ applications (Spearman coefficient ρ and intraclass correlation coefficient ICC).

	ρ	ICC
Leisure activities (hours/week)		
Previous year	0.81 (0.82)*	0.66 (0.60)*
Previous week	0.79 (0.76)*	0.75 (0.70)*
Occupational activities (hours/week)		
Previous year	0.58	0.49
Previous week	0.54	0.63

All values are significant ($p \leq 0.05$).

(*) Correlation after walking activity is excluded.

PAQ: Physical Activity Questionnaire.

Source: Author's own elaboration.

Table 4.
Correlation for hours/week between the first and the second PAQ application for group of activities (Spearman coefficient ρ and intraclass correlation coefficient ICC).

	Previous year		Previous week	
	ρ	ICC	ρ	ICC
Leisure activities (hours/week)				
Sports	0.61	0.68	0.54	0.53
Occupational activities (hours/week)				
Home	0.90	0.83	0.83	0.75
Craftwork Manufacture	0.97	0.65	0.74	0.57
**Fishery	0.93	0.85	0.78	0.58
Pen shell	0.89	0.80	0.79	0.93
Crab	0.90	0.89	0.50	0.26

All values are significant ($p \leq 0.05$).

**Fishery of pen shell and crab together.

Source: Author's own elaboration.

Interviews with key people as part of adaptation process was a fundamental step to identify in detail community's main traditional activities in order to list them in adapted questionnaire. This process allowed subsequent questionnaire applications focusing on activities related to their cultural context. Identification and description of activities and sub-activities were essential for subsequent assignment of their metabolic equivalents (METs) and to classify them as sedentary, light, moderate or intense. Therefore, METs values that best represent each of identified activities (sub-activities) were assigned based on Ainsworth's compendium. For activities not listed in the compendium, values were assigned by looking at similar activities. A MET represents oxygen consumption rate, approximately

3.5 ml/kg · min, for an average adult who is sitting quietly, whereas 6-MET requires 6 times resting energy expenditure (Ainsworth *et al.*, 2011).

Reproducibility

Twenty-six subjects who were originally interviewed also completed their second questionnaire. Associations of total previous-year and previous-week leisure and occupational activities are shown on table 3. Reported values represent Spearman coefficient ρ and intraclass correlation coefficient ICC between activities reported from first and second PAQ applied and expressed in hours per week (h/wk). First and second measurements of total previous-year leisure activities were highly correlated. Spearman correlation were almost the same when "walking" was excluded from total leisure activity ($\rho = 0.81$ including walking vs. $\rho = 0.82$ excluding walking; $p < 0.05$ for both cases). Moreover, first and second measurements of total previous-week leisure activities showed higher correlation when "walking" was included, in comparison to that found when it was excluded ($\rho = 0.79$ and $\rho = 0.76$, respectively; $p < 0.05$ for both cases). Regarding occupational activities (table 3), correlation was higher for that reported during previous-year in comparison to that reported during previous-week, with Spearman ρ values of 0.58 and 0.54, respectively; $p < 0.05$ for both cases.

Table 4 shows results of Spearman coefficient ρ and intraclass correlation coefficient ICC analysis by groups of activities (leisure and occupational) and by sub-groups of activities. Activities corresponding to the same type were grouped in a representative category (sports, home related, craftwork manufacture and fishery related). Results showed stronger correlations in previous-year activities group in comparison to that reported during previous-week. Spearman ρ correlation for previous-year "home related" activities were 0.90 and 0.83 for that of previous-week. Additionally, Spearman ρ correlation for previous-year sub-group of "craftwork manufacture" activities were 0.97 and 0.74 for that of previous-week. Similar to previous-year, Spearman ρ correlation for "fishery" group activities were 0.93 and 0.78 for that of previous-week. Results showed high reproducibility of adapted PAQ.

Correlation values above described were obtained expressing physical activity as hours per week. However, similar correlations values were observed when physical activity was expressed as METs-hour-week (data not shown). Previous-year Spearman ρ correlations

for leisure activities including and excluding “walking” were 0.83 and 0.89, respectively. Correlations for previous-week of leisure activities including and excluding “walking” were 0.81 and 0.84, respectively. Regarding occupational activities, a Spearman ρ correlation value of 0.70 for previous-year and of 0.51 for previous-week were found. In craftwork manufacture and fishery related activities cases, Spearman ρ correlations were 0.97 vs. 0.73 and 0.94 vs. 0.74, for previous-year and previous-week, respectively.

DISCUSSION

During adaptation process, common occupational activities among subjects were identified. Occupational activities were related to craftwork manufacture, home activities, and fishery. Each group of activities is further integrated by a series of sub-groups of activities that were important to know, break-down, and describe. This adaptation process made possible to place items of questionnaire in cultural context and identify relevant activities of this indigenous population (São-João *et al.*, 2013).

An important recommendation for those who want to use a PAQ is to adapt it in order to ask people about activities they are used to do and also to be able to assign metabolic equivalents to activities as accurate as possible. This means that adapted questionnaires for a particular community may not be generalized to other populations. Some words and meanings may be interpreted differently among subjects, age groups, and cultures. Furthermore, physical activity patterns may be different among communities due to different factors that should be taken into account before PAQs are applied.

In studies where reproducibility of PAQ was evaluated, similar correlations have been found. Kriska *et al.* (1990) found Spearman correlation values of $\rho = 0.92$ and $\rho = 0.62$ for previous-year and previous-week leisure activities in 21 to 36 years old ($n = 29$) age group. In addition, in 37 to 59 years old ($n = 17$) age group, correlation values of $\rho = 0.88$ and $\rho = 0.77$ were found for previous-year and previous-week leisure activities. In a global analysis, they found that correlation for leisure activities was stronger when “walking” was excluded. Furthermore, correlation of previous-year occupational activities was $\rho = 0.88$. Correlation results for test-retest method in Pima Indians were similar to those found in our study; correlation was greater for previous-year activities than that reported during previous-week.

In the study by Nang *et al.* (2011), correlations were found for moderate activities of $\rho = 0.58$ and of $\rho = 0.38$ for vigorous activities in IPAQ. Additionally, correlations of SP2PAQ were $\rho = 0.55$ and $\rho = 0.75$ for moderate and vigorous activities, respectively. Authors conclude that IPAQ had limited accuracy for distinguishing physical activity levels of individuals. Also they said that reproducibility of SP2PAQ is reasonably good and which can be used in large epidemiological studies.

In the reproducibility study of Korean Version of Neighborhood Physical Activity Questionnaire was assessed using Spearman correlation. Questionnaire was applied twice, one week apart. Considering total number of hours per week, values of $\rho = 0.57$ and $\rho = 0.66$ for moderate and vigorous intensity activities were found. Degree of agreement was defined as slight agreement ($\rho \leq 0.2$), fair (0.2 – 0.4), moderate (0.4 – 0.6), substantial (0.6 – 0.8), and almost perfect ($\rho \geq 0.8$) (Bae *et al.*, 2015).

Regarding studies in Mexican population, Medina *et al.* (2013) found a correlation of 0.55 and Vega-López, *et al.* (2014) found correlations of 0.61 and 0.65 for the SBAS and RAPA, respectively. Authors concluded that their results were modestly correlated. It is important to mention that questionnaires used by these studies are short versions compared to ours.

High-quality result found in this study, is in part due to previous training of interviewer. This consisted of advice to understand questionnaire in detail, which was previously applied to four volunteers. This training process allowed interviewer to be familiarized with questionnaire format, answer doubts about used technique to complete interview and to understand handling and processing of numerical data.

CONCLUSION

This study achieved description of activities inhabitants of Seri community perform as part of their everyday life in their socio-cultural context. It was also possible to recognize reported activities frequency and duration and to categorize them as leisure and occupational, both for women and men.

Additionally, questionnaire reproducibility was evaluated through test-retest method, and according to Spearman correlation values and confirmed by those found with intraclass correlation coefficients analysis,

it is possible to establish that physical activity questionnaire is a useful tool to estimate physical activity patterns in Comcáac community of the State of Sonora, and it can be used to study association among physical activity, obesity and health.

ACKNOWLEDGEMENTS

Study was supported by The Christensen Fund. We thank residents of Comcáac community for participating in this study. Our gratitude goes to José M. Moreno Abril, Alejandra Chávez Ríos, Lucía E. López Delgado and Alan R. García Alfaro. Special thanks are extended to Reyes Salomón Romero and Secretaría de Salud of Mexico.

REFERENCES

- Ainsworth, B. E., Haskell, W. L., Herrmann, S. D., Meckes, N., Bassett, D. R. Jr., Tudor-Locke, C., Greer J. L., Vezina, J., Whitt-Glover, M. C., & Leon, A. S. (2011). 2011 Compendium of physical activities: a second update of codes and MET values. *Medicine and Science in Sports and Exercise*, 43(8), 1575-1581.
- Alaez, C., Infante, E., Pujol, J., Duran, C., Navarro, J. L., & Gorodezky, C. (2002). Molecular analysis of HLA-DRB1, DQA1, DQB1, DQ promoter polymorphism and extended class II haplotypes in the Seri Indians from northwest Mexico. *Tissue Antigens*, 59(5), 388-396.
- Assah, F. K., Ekelund, U., Brage, S., Wright, A., Mbanya, J. C., & Wereham, N. J. (2011). Accuracy and validity of a combined heart rate and motion sensor for the measurement of free-living physical activity energy expenditure in adults in Cameroon. *International Journal of Epidemiology*, 40(1), 112-120.
- Bae, W. K., Cho, B., & Son, K. Y. (2015). Validity and reliability of the Korean version of neighborhood physical activity questionnaire. *Korean Journal of Family Medicine*, 36(3), 135-140.
- Bassett, D. R. Jr., Wyatt, H. R., Thompson, H., Peters, J. C., & Hill, J. O. (2010). Pedometer-measured physical activity and health behaviors in U.S. adults. *Medicine and science in sports and exercise*, 42(10), 1819-1825.
- Chun, M. Y. (2012). Validity and reliability of Korean version of international physical activity questionnaire short form in the elderly. *Korean journal of family medicine*, 33(3), 144-151.
- Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E. Pratt, M., Ekelund, U., Yngve, A., Sallis, J. F., & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine and science in sports and exercise*, 35(8), 1381-1395.
- Esparza, J., Fox, C., Harper, I. T., Bennett, P. H., Schulz, L. O., Valencia, M. E., & Ravussin, E. (2000). Daily energy expenditure in Mexican and USA Pima Indians: low physical activity as a possible cause of obesity. *International Journal of Obesity and Related Metabolic Disorders*, 24(1), 55-59.
- Haskell, W. L., & Kiernan, M. (2000). Methodologic issues in measuring physical activity and physical fitness when evaluating the role of dietary supplements for physically active people. *The American journal of clinical nutrition*, 72(2), 541-550.
- Helmerhorst, H. H. J., Brage, S., Warren, J., Besson, H., & Ekelund, U. (2012). A systematic review of reliability and objective criterion-related validity of physical activity questionnaires. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 103.
- Hong, T. K., Trang, N. H., Van der Ploeg, H. P., Hardy, L. L., & Dibley, M. J. (2012). Validity and reliability of a physical activity questionnaire for Vietnamese adolescents. *The international journal of behavioral nutrition and physical activity*, 9(1), 93-99.
- Hu, F. B. (2011). Globalization of diabetes: the role of diet, lifestyle, and genes. *Diabetes Care*, 34(6), 1249-1257.
- Kriska, A. M., Knowler, W. C., LaPorte, R.E., Drash, A. L., Wing, R. R., Blair, S. N., Bennett, P. H., & Kuller, L. H.. (1990). Development of questionnaire to examine relationship of physical activity and diabetes in Pima Indians. *Diabetes Care*, 13(4), 401-411.
- Luque, D., & Robles, A. (2006). *Naturalezas, saberes y territorios Comcáac (Seri): diversidad cultural y sustentabilidad ambiental*. Hermosillo, Sonora, México: Centro de Investigación en Alimentación y Desarrollo, A.C.
- Macfarlane, D., Chan, A., & Cerin, E. (2010). Examining the validity and reliability of the Chinese version of the international physical activity questionnaire, long form (IPAQ-LC). *Public health nutrition*, 14(3), 443-450.
- Medina, C., Barquera, S., & Janssen, I. (2013). Validity and reliability of the international physical activity questionnaire among adults in Mexico. *Pan American journal of public health*, 34(1), 21-28.
- Nang, E. E. K., Ngunjiri, S. A. G., Wu, Y., Salim, A., Tai, E. S., Lee, J., & Van Dam, R. M. (2011). Validity of the international physical activity questionnaire and the Singapore prospective study program physical activity questionnaire in a multiethnic urban Asian population. *BioMed Central Medical Research Methodology*, 11(1), 141-151.
- Neilson, H. K., Robson, P. J., Friedenreich, C. M., & Csizmad, I. (2008). Estimating activity energy expenditure: how valid are physical activity questionnaires? *The American journal of clinical nutrition*, 87(2), 279-291.
- Noriega-Orozco, B. R. (2007). Arte COMCA'AC: mujeres, manejo de recursos y mercado. *Ra Ximhai*, 3(1), 1-25.
- Ono, R., Hirata, S., Yamada, M., Nishiyama, T., Kurosaka, M., & Tamura, Y. (2007). Reliability and validity of the Baecke physical activity questionnaire in adult women with hip disorders. *BMC Musculoskeletal Disorders*, 8(1), 61-66.
- Rentería-Valencia, R. F. (2007). *Seris / Pueblos indígenas del México contemporáneo*. México: Comisión Nacional para el Desarrollo de los Pueblos Indígenas.
- São-João, T. M., Rodrigues, R. C. M., Gallani, M. C., Miura, C. T., Domingues G. D. B., Godin, G. (2013). Cultural adaptation of the Brazilian version of the Godin-Shephard Leisure-Time physical activity questionnaire. *Revista de Saúde Pública*, 47(3), 479-487.

- Siebeling, L., Wiebers, S., Beem, L., Puhan, M. A., & Ter Riet, G. (2012). Validity and reproducibility of a physical activity questionnaire for older adults: questionnaire versus accelerometer for assessing physical activity in older adults. *Clinical epidemiology*, 4, 171-180. doi: 10.2147/CLEP.S30848
- Tamioka, K., Iwamoto, J., Saeki, K., & Okamoto, N. (2011). Reliability and validity of the international physical activity questionnaire (IPAQ) in elderly adults: The Fujiwara-Kyo Study. *Journal of Epidemiology*, 21(6), 459-465.
- Villela, G. J., & Palinkas, L. A. (2000). Sociocultural change and health status among the Seri Indians of Sonora, Mexico. *Medical anthropology*, 19(2), 147-172.
- Vega-López, S., Chavez, A., Farr, K. J., & Ainsworth, B. E. (2014). Validity and reliability of two brief physical activity questionnaires among Spanish-speaking individuals of Mexican descent. *BMC research notes*, 7(1), 29. doi: 10.1186/1756-0500-7-29