Journal of Physical Education and Sport ® (JPES), 18(3), Art 229, pp. 1549 - 1554, 2018
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

The association between socio-economic indicators and the cantonal sports performance in the national sport games Costa Rica 2016

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Published online: September 30, 2018
(Accepted for publication July 29, 2018)
DOI:10.7752/jpes.2018.03229

Abstract:
The aim of the study was to determine the association between economic and social indicators and their predictive value for cantonal sports performance in athletes who participated in the 35th National Sport Games 2016 in San José, Costa Rica. Each canton was ranked according to the total medals obtained during the games and correlations were computed with the socio-economic indicators human development index (HDI), human poverty index (HPI), life expectancy index (LEI), knowledge index (KI), material well-being index (MWI), HDI related to gender (GDI), and gender empowerment measure (GEM). Spearman Rho bivariate correlations and a multiple lineal regression were used to analyze data. Significant associations were found between the cantonal position in the Games and the HDI ($r_\rho = 0.307$, $p = 0.005$), GDI ($r_\rho = 0.316$, $p = 0.004$), GEM ($r_\rho = 0.326$, $p = 0.003$), HPI ($r_\rho = - 0.310$, $p = 0.005$), MWI ($r_\rho = 0.335$, $p = 0.002$); however, non-significant correlations were found for LEI ($r_\rho = 0.144$, $p = 0.201$) and KI ($r_\rho = 0.335$, $p = 0.231$). Multiple linear regression analysis revealed that GDI ($\beta = 0.268$; $p = 0.016$) was the only predictive variable that entered in the model, explaining 7.2% of the variance in the total number of medals. In conclusion, although various socio-economic indicators were associated with sport performance, only the HDI related to gender was the most important predictor. More attention should be given to factors that gender equality in the different cantons, as it has an association with sport success.
Key Words*:* National Games, sports performance, social factors, economic factors

Introduction

Competitive sports in a globalized world require increased governmental investment and support. National institutions that administer and lead competitive sport must assume new challenges offering better training facilities and competitive conditions for their athletes. Furthermore, territorial policies linked to sports culture development are a crucial factor to observe sports integration. However, some political tensions exist in every place, especially due to the limited budget every city has to face. For this reason, resources assigned to different cities have been unequally distributed throughout history, which means that every geographic-administrative unit (e.g., province, canton or community) should only develop the sports skills in the disciplines where they have the opportunity to excel (Gutiérrez, 2009).

International institutions design and measure the living conditions of countries using different indicators such as indexes that consider diverse domains of development of their inhabitants. For example, the human development index (HDI) from the United Nations Development Programme calculates the average of a geographic area achievements in three basic dimensions of the human development: a) long healthy life, taking into account life expectancy, b) knowledge, considering the rate of literacy in adults (with a weight of two-thirds) and a combined net rate of registration in elementary, middle and high school (with a weight of one third), and c) decent standard of living, calculated by the Material Well-Being Index (MWI) on residential electricity consumption (United Nations Development Programme & School of Statistics-University of Costa Rica, 2016). Costa Rica is considered a country with high HDI, and in some indicators such as life expectancy even outperforms developed countries such as the United States (Rojas, 2008; Rosero-Bixby & Dow, 2016). As general information, Costa Rica is a country divided into seven provinces and 81 administrative territories called cantons.

A positive correlation ($r = 0.27$) between HDI and the physical inactivity prevalence in worldwide population has been found (Dumith, Hallal, Reis, & Kohl, 2011). This is a disruptive finding that means that the wellness and longer life expectancy of the inhabitants reveals less physical activity. That means that underdeveloped countries' inhabitants show lower prevalence of physical activity (18.7%) than the developed countries' inhabitants (27.8%). In addition, 20% of adults are sedentary and physical inactivity is more frequent

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in urban areas in women and in older adults (Dumith et al., 2011) defining the groups at risk of presenting illnesses due to a sedentary lifestyle (e.g., obesity, diabetes mellitus, hypertension, and some types of cancer).

The HDI has been associated to anthropometric indicators such as height (Grasgruber, Sebera, Hrazdíra, Cacek, & Kalina, 2016). In a study on 105 people to discriminate the predictor of the greatest height of inhabitants, it was found that protein consumption (r = 0.85) and the HDI (r = 0.84) were the best predictors to obtain a better height (Grasgruber et al., 2016). An increased body height has been related to best sport performance, for example, in basketball and volleyball (Carter, Ackland, Kerr, & Stapff, 2005; Duncan, Woodfield, & al-Nakeeb, 2006; Gualdi-Russo & Zaccagni, 2001), or better perceived among athletes showing that to be the fastest and tallest is especially beneficial to performance in sports (Krause et al., 2015).

The HDI has also been used in sociological sports research where it has been found an association with player's penalization in worldwide football (soccer) championships (Imperiale-Hagerman, 2011). The evidence indicate an inverse association between HDI and the number of penalty cards (i.e., yellow and red) shown per game in the first (r = -0.24) and in the second phase (r = -0.36) of important tournaments. That means that the highest the HDI of a country, referees were less susceptible to showing the cards during the game (Imperiale-Hagerman, 2011). In Costa Rica, to the best of our knowledge this is the first study using socio-economic indicators associated with the performance of the different communities' participating in sports events. Therefore, the main purpose of this study was to determine the association between different socio-economic indexes and the athletes' performance of the 81 cantons of the country that participated in the 35th National Sports Games 2016 held in San José, Costa Rica.

Material & methods

Information Sources

Data regarding athletes' participation for every 81 cantons in the 35th National Sports Games 2016 were taken from the official site of Costa Rican Institute of Sports and Recreation (ICODER, for its acronym in Spanish) (http://www.jdnicoder.com). These games took place in July, 2016. Later, on July 17, 2016 the medal section was reviewed to obtain the number of medals of the ranking cantons.

The economic and social indexes were retrieved from the web Cantonal Human Development Atlas (United Nations Development Programme & University of Costa Rica, 2016a). This site works together with United Nations Development Programme and the School of Statistics of the University of Costa Rica and describe the following economic and the social indexes (United Nations Development Programme & University of Costa Rica, 2016a, 2016b, 2016c, 2016d, 2016e):

a. The human development index (HDI), which indicates the mean achievement of a specific geographical area in three basic dimensions of human development. First, a long and healthy life calculated by life expectancy at birth. Second, knowledge, calculated by the literacy rate of adults (with a weight of two thirds) and the combined net rate of registration in elementary, middle, and high school (with a weight of one third). Third, a decent life standard as measured by the MWI centered on the residential electricity consumption by client.

b. The human poverty index (HPI), which measures the limitations of the three basic dimensions of human development reflected in the HDI and social exclusion. The first element is a long and healthy life, defined as the vulnerability of dying at a young age calculated by the probability at birth of not surviving to age of 60. The second aspect is knowledge, defined as the exclusion to literacy and communications measured by the adult percentage (up to 18 years) who have completed at least third grade of elementary school. The third element is the descent standards of life as measured by the percentage of poor living conditions. Finally, social exclusion as measured by the rate of unemployment rate over a period of four months or longer.

c. The life expectancy index (LEI) on the crude mortality rate for every 1.000 inhabitants and the percentage of people up to 65 years. It also estimates standardized LEI with life expectancy up to 85 years old.

d. The knowledge index (KI), which includes adult literacy rate and crude rate of registration for elementary, middle, and high school.

e. The material well-being index (MWI), which refers to the residential electric consumption of kWh per capita adjusted.

f. The HDI related with Gender Development Index (GDI), an index that adjusts the HDI to show inequality between men and women in the following aspects. First, a long and healthy life measured by the life expectancy at birth. Second, knowledge as measured by the adult literacy rate and the combined crude rate of registration in elementary, middle, and high school. Third, descent standards of living measured by the estimated material well-being.

g. The Gender Empowerment Measure (GEM) focused on women's opportunities instead of their abilities. It reflects inequalities in political participation and decision-making power measured by women and men having a political leadership position in the municipality of each canton, economic participation and decision-making power measured by the percentage of men and women in leadership positions (e.g., people in board levels in the public and private administration of professional, scientific and intellectual and technical levels), and power of economic resources measured by the estimated material well-being of men and women.

Statistical Analyses

Statistical analysis was performed with the IBM-SPSS Statistics, version 22 (IBM Corporation, Armonk, New York). Data are presented as mean (M) and the standard deviation (± SD) for continuous variables (e.g., social and economic indexes). A Spearman Rho (r_ρ) bivariate correlation analysis was made to associate the positions of the cantons on the total medals and the position in every economic and social index.

With the continuous data a prediction model of sports performance using a multiple linear regression analysis was made in which the criteria variable or dependent ($\hat{Y}$) was the total of medals obtained. The predictor variables or independent (X_n) were: 1) HDI, 2) PHI, 3) LEI, 4) KI, 5) MWI, 6) GDI, and 7) GEM. The predictive variables were continuous and they were taken using the "stepwise" method and the assumptions of normality, homoscedasticity, and linearity were also studied (Pedhazur & Pedhazur Schmelkin, 1991). The model studied was $\hat{Y} = a + b_1(X_1) + b_2(X_2) + b_n(X_n) \pm$ error, in which $\hat{Y}$ is the dependent variable, a is the constant, and X represents every predictive variable that enters in the model (Moncada-Jiménez, 2005).

Results

In the 35th National Sports Games 2016 held in San José, Costa Rica, participated athletes from the 81 cantons; however, only athletes from 66 cantons obtained medals. The official winner was the canton of San José with 312 medals (Gold = 122, Silver = 90, and Bronze = 100), Alajuela canton was second with 300 medals (Gold = 103, Silver = 98, and Bronze = 99), and Belén canton third with 160 medals (Gold = 72, Silver = 47, and Bronze = 41). Descriptive statistics of predictive variables of sports performance are shown in table 1.

Table 1. Descriptive statistics of the predictive variables of athletic performance.

Variable	Media	± DE	Minimum	Maximum
Human Development Index	0.77	0.07	0.62	0.94
HDI related to gender	0.73	0.06	0.60	0.88
Gender Empowerment Measure	0.77	0.06	0.46	0.93
Human poverty index	17.0	4.92	11.67	27.28
Life expectancy index	0.85	0.04	0.76	1.00
Knowledge index	0.93	0.06	0.72	1.00
Material well-being index	0.52	0.15	0.26	1.00

Significant correlations are found between cantons' position in the Games and the HDI ($r_\rho = 0.307$, $p = 0.005$), GDI ($r_\rho = 0.316$, $p = 0.004$), GEM ($r_\rho = 0.326$, $p = 0.003$), HPI ($r_\rho = -0.310$, $p = 0.005$), MWI ($r_\rho = 0.335$, $p = 0.002$), but none for LEI ($r_\rho = 0.144$, $p = 0.201$) nor KI ($r_\rho = 0.335$, $p = 0.231$).

Exploratory analysis.

An exploratory analysis was used to confirm that that model was appropriate for the multiple linear regression analysis technique. Not all the distribution of scores of the predictive variables were normal based on asymmetry and kurtosis values (Moncada-Jiménez, 2005). The symmetry values and kurtosis were respectively for GEM (-1.677, 8.293), HPI (0.451, -1.366), LEI (0.781, 1.230), and KI (-1.392, 1.220), and MWI (0.830, 1.599). Thus, the predictive model included only the ones that presented normal distribution, that is, the HDI (symmetry = 0.196, kurtosis = 0.410) and GDI (symmetry = 0.148, kurtosis = 0.408).

Predictive model analysis.

The basic assumptions of the multiple linear regression analysis were accomplished for the selected model. The assumption of independency of the scores was accomplished since medals gained by one canton were independent of those obtained for another canton (e.g., not all the cantons competed against each other in the Games). The assumptions of normality, homoscedasticity, and linearity were also studied by visual inspection of plots of unstandardized predicted scores and unstandardized residuals. There were no cases in which the scores were considered influential as indicated by Cook's Distance (C < 1.0).

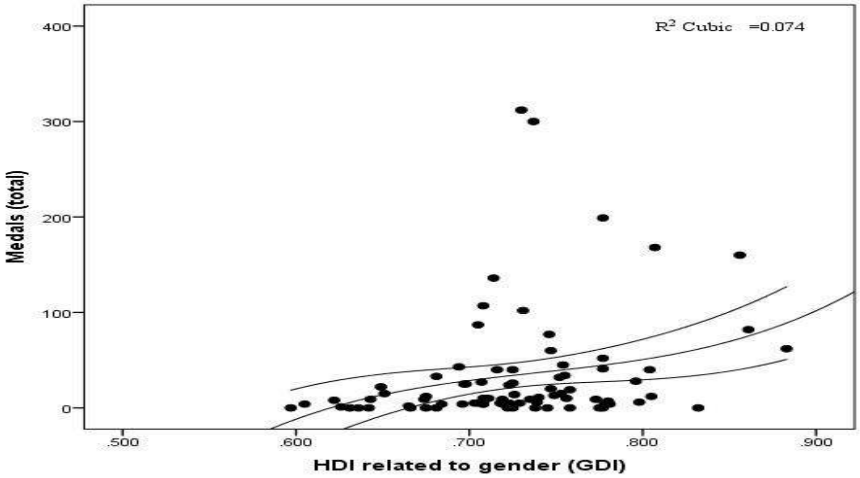

Fig. 1. Association between HDI related to gender (GDI) and the total amount of medals. The best fit line appears in the middle of two lines, which represents the 95% confidence interval.

The multiple linear regression analysis indicated that the GDI ($\beta = 0.268$; $p = 0.016$) was the only predictive variable that entered in the model. As a result, the linear regression equation that predicts cantonal performance using this model is: $\hat{Y}$ (total of medals) = -170.602 + 281.104 (GDI) ± 57.5 medals (Figure 1). The model explains 7.2% of the variance in the total of medals ($R^2 = 0.072$), which means that 92.8% of the variance is explained by other variables not included in the model studied.

Discussion

In this study we determined the association between socio-economic indexes and the athletes' performance of the 81 cantons that participated in the 35th National Sports Games 2016 held in San José, Costa Rica. The main finding was that the cantons with higher HDI, GDI, GEM and MWI obtained more medals and the cantons with higher HPI obtained fewer medals. No significant association was found in relation to the number of medals and LEI or KI.

Breuer and Wicker (2008), researched the associations of a variety of demographic and economic factors and sports performance in Germany. The evidence found suggests that economic factors allied to better socio-economic level predicted better sports performance. Similar results we found in this study and might be partly explained by an increase in governmental investment in sports over the last decade (Moncada-Jiménez, Crow, & Alfaro-Barrantes, 2016).

It has been reported that the better socioeconomic status a canton has, the better development it has due to physical activity can be allied to the socioeconomic status of families (Patnode et al., 2010). Others (Maree, Hashemi, Hojjati, Nikravan, & Feizabadi, 2013), argue that social and family support joined with socioeconomic status play a fundamental role in physical activity participation, stimulating competitiveness in physical activities. Those athletes with low socioeconomic status frequently do not have the same access to facilities to practice physical activities compared to those who do have better incomes. That could give less probabilities of receiving support (Patnode et al., 2010).

Maree et al. (2013), examined families' socioeconomic status and social support in athletes. The evidence found suggests a significant difference between the number of social factors and parents' support for physical activities in the North and South area of Tehran, Iran. Previous study comparisons suggest that families with better socioeconomic status have a positive effect on the athlete's performance. The National Games held in Costa Rica are considered "family games", given that most amateur athletes are between the ages of 7 to 23 yrs.; therefore, most parents and close family travel to the canton to support them.

Patnode et al. (2010), analyzed the demographic, social and environmental associations with physical activity in 294 children and adolescents of Minnesota, USA. In the study is highlighted that geographical position influences as a positive factor in practicing physical activity affecting directly in sports performance. Dollman and Lewis (2009), studied in the South of Australia, the association between physical activity and socioeconomic, psychosocial and environmental position in a group of students (n = 3300) and parents (n = 1720). In the study, participants from a wide variety of socioeconomic groups were included. The evidence suggests that children from low socioeconomic level do not have the same opportunities to access facilities for practicing physical activity compared with those with higher socioeconomic levels. National regulations in Costa Rica (Government of Costa Rica, 1998), guarantee the free access to sport facilities (for those owned by the State), and cantonal sports committees oversee the proper access to all individuals regardless of gender, age and disability status.

A study performed in elementary schools in Canada, with 160 students 12-18 yr. old (Humbert et al., 2006), reported that environment (e.g., living near to sport facilities, having money for expenses, quality of facilities, and security) is very important for youngers who live in low socioeconomic conditions. Results also show that social factors (e.g., friends and family) help improving participation in those who live in both high and low socioeconomic levels. Raudsepp (2006), studied the association between physical activity and socioeconomic status in 326 adolescents in the Republic of Estonia. The main finding of the study was that boys were significantly more active than girls and social level was significantly related to physical activity.

Costa Rica is 51100 km^2 (31752 mi^2) and the provinces are San José (where the capital and the canton of San José are located), Alajuela (where the cantons of Alajuela and Belén are located), Cartago, Heredia, Guanacaste, Puntarenas and Limón (Rojas, 2008). The reported population up to June 30, 2016 was almost five million inhabitants (National Institute of Statistics and Census, 2016), with the province of San José having the highest inhabitant concentration (336792 inhabitants), Alajuela (297879 inhabitants), and Belén (25544 inhabitants). Therefore, it might be explained only by population the cantons that dominated the medal number. It is important to highlight that in 2014 the male population represented the majority (2380927) of participants with 50.04% of the total compared to women (2376679) representing a 49.96% (Datosmacro, 2014). In our study, the results by variables of GDI and GEM might be explained due to the higher masculine participation as shown in previous studies (De Frenne, Zaragozano, Otero, Aznar, & Sánchez, 1997; Riddoch, Savage, Murphy, Cran, & Boreham, 1991), in which men showed more interest on physical activities and sports than women, who devoted less time to physical activities. Those findings show that there is not the same participation equality in sports although Costa Rica supports the same equalities and opportunities to access for both genders (Government of Costa Rica, 1998).

Conclusions

In conclusion, Costa Rica's cantons with higher HDI, GDI, GEM and MWI obtained more medals in the National Games and the cantons with higher PHI obtained fewer medals. However, no significant association was found between the LEI or the KI. It is necessary to explore more statistical models that include other environmental, social and economic factors that explain the differences between the sports performance in the cantons of the country in order to understand what factors could reduce the inequalities in sports.

Conflicts of interest - The authors declare no conflicts of interest.

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