126 - A SIMILARITY ANALYSIS TO DETERMINE RACE SEQUENCES IN REGIONAL SWIMMING COMPETITIONS

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INTRODUCTION

The first swimming competition dates back to the 19th century. At the same time, the Olympic games occured and had three swimming races in their chronogram: 100, 400 and 1200m Freestyle (RODRIGUES, 1997). Due to the few number of races during this era, it was obvious that the organization of the sequences of races did not cause many problems.

As the sport evolved, new styles were adopted (Backstroke, Butterfly and Breastroke), and adopted a standardization of measurements in meters (50, 100, 200, 400, 800, and 1500m Freestyle; 50, 100, and 200 m of Back, Breast and Butterfly, and 100, 200 and 400 m Medley). Disregarding relay races, a total of 18 official races were defined (FINA, 2012).

Despite the large increase in number of races, this large number does not seem to cause any organization and sequence problems at large-scale competitions (olympics and world championships). This is due to their long durations, which can take up to two-week. As well, some of the new races, even though official, do not occur in these competitions, for example, 50m Backstroke, Butterfly and Breastroke races at the Olympic Games (COI, 2012; FINA 2012).

Not being part of the International Swimming Federation (FINA), the organization and sequences of swimming races at regional and state level are randomly disposed, and even less regulated by state federations. A lack of organization of such races, can affect the performance of athletes. Barnett (2006) showed that a necessary recuperation time is needed between efforts, in order for the athlete to achieve his maximum performance.

Therefore, the objective of this study was to adopt a scientific approach to the organization and race sequences of regional swimming competitions in Santa Catarina, using a multivariate approach between all the races of the participating swimmers during the 2012 season.

METHODS

This new adopted technique aims to detect the similarties between the race frequencies by the same swimmer during the season, using a scientific approach commonly used for environemntal and ecological studies between communities (CLARK and WARKWICK, 1994). This similarity measure is numerical and quantifies the degree of association between objects or descriptors (CLARKE and GORLEY, 2006).

Data for this study were obtained from the “Federação Aquática de Santa Catarina public database, CBDAWEB online access. The sample size to be used was determined using the following criteria: a) registered swimmers in Santa Catarina, male and female, in the categories Child 1 (13 years) up to Senior (20 years and over); b) swimmers participating in atleast 1 state or southern Brazil championship from the start of the 2012 season until October 2012. This study did not differenciate between 25 and 50m pool sizes. The sample was compsed of 358 individuals, with 115 female and 243 male participants. The obtained data were compiled in Excel 2007 for Windows®, where the individuals were organized according to their swam races, using only the best technical score obtained independent of the competition. This technical score is calculated based on the average from the 25 best world times (FINA Ranking), from the previous season, which serves as a comparative for the different races in a competition, determining the best performance off all the individual winners from all races. For the analysis, the statistical package Plymouth Routines In Multivariate Ecological Research Primer® 5 ß version R3 was used, to determined if any similarities exist between the choice of races performed by the same swimmer. A similarity matrix was used, determined by the Bray-Curtis similarity index. Raw data was not transformed to obtain the Cluster Analysis, which translates to a hierarchial grouping of variables. The resulting dendogram, used values from the rank similarity matrix, and using the appropriate algorithm, calculates the distances between the groupings in order to compare the seperations and visualize the blocks (CLARKE and GORLEY, 2006).

RESULTS

The presented results were divided according to the swimmer's sex and the similarity of the chosen races. The female results are shown in figure 1, where three groupings in the dendrogram are formed. In the first group, a similarity was found between the 400 and 800 m Freestyle races, followed by the 1500m Freestyle and 200m Butterfly, respectively.

In the middle group, there are three smaller blocks: the first formed by the races 100 and 50m Butterfly; the second by 100 and 50m Freestyle, which later unites with the 200m; and the third sub-group is made up of 50, 100 and 200m Free.

The third group is made up of 2 sub-blocks: the first formed by 100m and 200m Breastroke, later uniting with the 50m; and the second formed by the 200m and 400m Medley.

Considering the large groups in terms of similarity, a grouping was observed at the second and third group, and later in the sequence uniting with the first group. The 100m Medley race was an outlier data point, since there was few data recorded for this race.

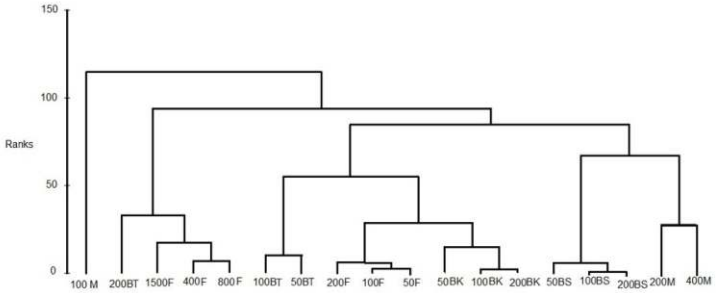


Figure 1 –Dendrogram similarity of races female.

The male results are shown in figure 2, where the dendogram also formed three main groups. In the first group, the races 1500 and 800m Freestyle were grouped along with the 400m Medley and 200m Butterfly. The middle group is divided into three sub-groups. The first sub-group is composed of the 100m and 200m Backstroke races, along with the 50m. The middle sub-group composed of 50m and 100m Butterfly. The third sub-group is composed of thr 50 and 100m Freestyle, which later unite with the 200 and 400m Freestyle, respectively. The third group is composed of the 100 and 200m Breastroke races, along with 50m Breastroke, 200m and 100m Medley in the following order. The joining of the three main groups occurs first with the third and second group that later join with the first group.

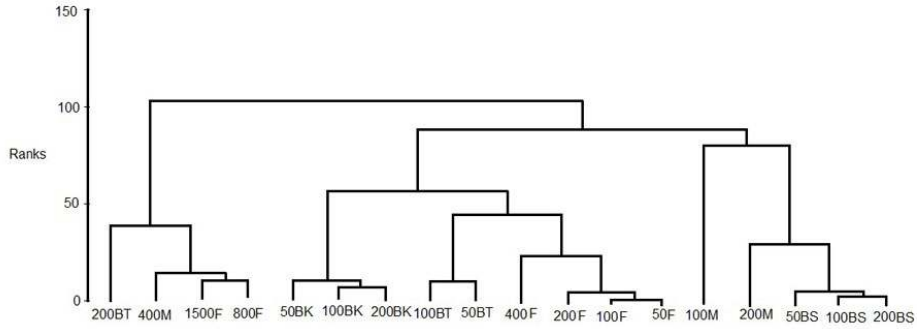


Figure 2 –Dendrogram similarity of races male.

DISCUSSION

This scientific approach was implicated to evaluate the factors of high performance swimming in order to highlight the importante of this sport phenomenon and contribute to the understanding and refiness of this modality (MENZEL, 1997). Despite the complexity of aquatic sports, physiological and pyschological-related aspects to swimming movement biomechanics have been widely studied (GUZMAN, 2008). Since there are few studies that have adressed organization and sequences of races in competitions, our results can be used to compare with those currently implemented in regional competitions in Santa Catarina, compare with the physiological parameters that influence performance.

De Rose Junior (2002) studied the effects of stress in competitors and found that despite the individual factors ivolved, like physical capacity, technical ability, lesions, etc, situational factors exist that are related to specific competition aspects like the technicals and referees. The competition in itself is a stressor, although the sequences of the swim races can aid in the reduction of such stress and create an environment to favour the highest performance. It was observed after performing this study that many races have been organized inadequately. For example, for fermale athletes, the 400m Medley followed by the 200m Freestyle; the 100m Butterfly followed by the 50m Backstroke; the 100m Backstroke followed by the 50m Freestyle. As for the male atheletes, the following errors were: 100m Butterfly followed by 50m Backstroke; 100m Freestyle before the 200m Backstroke; 50m Breastroke followed by the 100m Medley; the 100m Backstroke followed by the 50m Freestyle, and among many other races that formed the same group in the analysis.

The results encountered in our study suggest that the ideal organization of races in a swimming competition should be done such that the races that formed a group not occur in the same sequence, due to their similarity. At the moment that this criteira can no longer be respected, similar races should be kept at the farthest seperation time possible, considering that without appropriate recuperation time the athlete cannot maintain a high performance level (COCHRANE, 2004).

West et al. (2012) assessed performances of international swimmers for 200m Freestyle at 20 and 45 minutes recuperation times. Results showed that a 20 minute recuperation period after warm-up, favoured race performance (1.5 ± 1,1%) when compared to the 45 minute period. Such findings suggest that placing long races, like the 1500m Freestyle for example, at the beginning of the competition, is not appropriate since those in following races would loose their warm-up.

Hargreaves et al. (1998) analised the potential of six individuals after performing a 30 second maximum cicloergonomic stroke. At every third repetition, intervals of 4 minutes of passive recuperation were done. The interval bewteen the third and last repetition was composed of a 4 minute rest, followed by a 30-35% effort exercise of O_2 maximum, and 60 minutes of rest. Results showed a reduction in peak potential between the first three repetitions. Nevertheless, the first and last repetitions did not differ. Once again, these results suggest a long rest interval to permit athletes to attain their best performance. Therefore, it is evident that a proper sequence and organization of races in competitions have an important role in determing the outcome of the swimmers and requires further studies.

FINAL CONSIDERATIONS

Considering that the organization and sequences of races in regional competitions in the state of Santa Catarina is inadequate and negatively influences the performance of swimmers, this study aimed to scientically subsitute the assembly order in competitions, statistically analysing the similarites between races.

As a consequence, this study aimed to address a new phenomenon that is being uncovered and suggested criterias to determine the race readyness of athletes. No specific simulation of race sequencing was presented for such competitions, since it is always necessary to consider the quantity of races in a competition, number of available days, and number of competitors involved.

Furthur suggestions for future studies include the analysis of organization of other races in other states and at other competitive levels.

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A SIMILARITY ANALYSIS TO DETERMINE RACE SEQUENCES IN REGIONAL SWIMMING COMPETITIONS.

ABSTRACT

The aim of this study was to present a scientific approach on the organization and sequences of swimming races in the state of Santa Catarina, based on the races by the same swimmer during the 2012 season. Results from 358 individuals, with 243 male and 115 female participants, were obtained from the public database of the Aquatic Federation of Santa Catarina (FASC). These results were filtered according to the best technical score acheived, independent of the race. To analyze the races, a Bray-Curtis similarity matrix was performed to obtain a cluster analysis. This analysis was depicted by a dendogram, determined by the rank similiarity values in the matrix, which calculates the distances between the groupings. For the female competitiors, results presented 3 group formations, formed by similarities between races shown as: All 200 and 400m Breastroke and Medley races in one group; all 400, 800 and 1500m Freestyle, 200m Butterfly, and 400m Medley in another group; and the remaining in the last group. Considering the similarities between races, it is possible to organize the sequence of the competition using a scientific basis that enables swimmers to achieve their best performance.

KEYWORDS: Swimming. Competition. Performance.

ANALYSE DE SIMILTUDE POUR DETERMINER LA SEQUENCE DES EPREUVES DE NATATION DANS LES COMPETITIONS REGIONALES

RÉSUMÉ

Le but de cette étude est de présenter une approche scientifique du processus d'organisation de la séquence des épreuves de natation dans les compétitions régionales dans l'état de Santa Catarina, fondée sur la similitude de la preuve contestée par le nageur pendant la saison 2012. Les résultats des tests de 358 sujets, 243 hommes et 115 femmes, ont été obtenus à travers de bases de données publiques disponibles par la Fédération Aquatique de l'état de Santa Catarina (FASC) et ont été filtrées en fonction du meilleur indice technique obtenu indépendamment du championnat. Pour l'analyse et la comparaison des épreuves de natation, nous avons utilisé la matrice de similtude calculée par l'indice de similtude de Bray-Curtis, qui a donné lieu à l'analise de Cluster. Cette analyse a été démontrée par un dendrogramme généré avec les valeurs de la matrice de similtude de Ranks, qui calcule la distance des groupements par son algorithme. Les résultats montrent la formation de trois blocs formés par la similtudes des épreuves. Pour les femmes, les blocs sont representés comme suit: toutes les épreuves de la brasse avec les épreuves de 200 et 400 mètres quatre nages dans un bloc, l'épreuve de la 400, 800 et 1500 mètres nage libre plus l'épreuve de 200 mètres papillon dans un autre bloc et autres éléments d'épreuve dans un troisième bloc. Chez les hommes, il ya aussi la formation de trois grands blocs: les épreuves de la brasse avec 100 et 200 mètres quatre nages dans un bloc, l'épreuve de 800 et 1500 mètres style libre plus le papillon 200 mètres avec 400 mètres quatre nages dans un autre bloc et d'autres éléments dans un troisième bloc. Compte tenu de la similitude entre les éléments d'épreuve, il est possible d'organiser la séquence de base scientifique permettant aux nageurs de compétition obtenir les meilleures performances.

MOTS-CLÉS: Natation. Competitions. Performance.

SIMILITUD ANALISIS PARA DETERMINAR LA SECUENCIA DE LAS PRUEBAS DE NATACIÓN EN LAS COMPETICIONES REGIONALES

RESUMEN

El objetivo de este trabajo es presentar un enfoque científico para el proceso de organización de la secuencia de las pruebas de natación en las competiciones regionales en el estado de Santa Catarina, con base en la similitud de las pruebas disputadas por el mismo nadador durante la temporada 2012. Los resultados de las pruebas de los 358 sujetos, 243 hombres y 115 mujeres, se obtuvieron a partir de bases de datos públicas disponibles de “Federação Aquática de Santa Catarina (FASC)” y se filtra de acuerdo con el mejor índice técnica obtenida independientemente de campeonato. Para el análisis y la comparación de las pruebas de natación, se utilizó la matriz de similitud calculado por el índice de similitud de Bray-Curtis, que condujo a análisis de agrupamiento. Este examen se demostró en un dendrograma generado con los valores de la matriz de similitud de Ranks, que calcula la distancia entre los grupos a través de su algoritmo. Los resultados muestran la formación de tres bloques formados por la similitud entre las pruebas para las mujeres: todas las pruebas de Braza con 200 y 400 metros Estilos en un bloque, las pruebas de 400, 800 y 1500 metros Libres más de 200 metros Mariposa en otro bloque y otras pruebas en un tercer bloque. En los hombres, hay también la formación de tres bloques principales: todas las pruebas de Braza con Estilos 100 y 200 metros en un bloque; pruebas de 800 y 1500 metros Libres más 200 metros Mariposa y 400 metros Estilos en otro bloque y otras pruebas en un tercer bloque. Teniendo en cuenta la similitud entre las pruebas, es posible organizar la secuencia de la competencia con base científica que permitiendo nadadores lograr el mejor rendimiento.

PALABRAS CLAVE: Natación. Competiciones. Rendimiento.

ANÁLISE DE SIMILARIDADE PARA DETERMINAR A SEQUÊNCIA DAS PROVAS DE NATAÇÃO EM COMPETIÇÕES REGIONAIS

RESUMO

O objetivo do presente estudo é apresentar uma abordagem científica para o processo de organização da sequência das provas de natação em competições regionais no Estado de Santa Catarina, baseada na similaridade das provas disputadas por um mesmo nadador durante a temporada de 2012. Os resultados das provas de 358 indivíduos, sendo 243 do sexo masculino e 115 do sexo feminino, foram obtidos através do banco de dados público disponibilizado pela Federação Aquática de Santa Catarina (FASC) e foram filtrados de acordo com o melhor índice técnico obtido independentemente do campeonato. Para análise e comparação das provas de natação, foi utilizada a matriz de similaridade calculada pelo índice de similaridade de Bray-Curtis, que deu origem à análise de Cluster. Tal análise foi demonstrada por um dendrograma, gerado com os valores da matriz de similaridade de Ranks, que calcula a distância entre os agrupamentos através de seu algoritmo. Os resultados evidenciam a formação de três blocos, sendo eles formados pela similaridade entre as provas, para o sexo feminino, apresentados da seguinte forma: todas as provas de Peito com as de 200 e 400 metros Medley em um bloco; as provas de 400, 800 e 1500 metros Livres mais a de 200 metros Borboleta em outro bloco e as demais provas em um terceiro bloco. No masculino, observam-se também a formação de três grandes blocos: todas as provas de Peito com as de 100 e 200 metros Medley em um bloco; as provas de 800 e 1500 metros Livres mais as de 200 metros Borboleta com as de 400 metros Medley em outro bloco e as demais provas em um terceiro bloco. Considerando-se a similaridade entre as provas, é possível organizar a sequência da competição com base científica possibilitando que os nadadores possam alcançar o melhor desempenho.

PALAVRAS-CHAVE: Natação. Competição. Desempenho.