

Characterization of variables associated with sports performance: interdisciplinarity in women's soccer in Colombia

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Abstract:

Characterizing the variables associated with sports performance in women's soccer is necessary to favor the sports preparation of the player. This study aimed to evaluate the association between performance characteristics (morphofunctional) and characteristics (psychosocial and nutritional) in female soccer players in Bogotá. The study included 81 players grouped by position, based on the analysis of morphological (somatotype), functional (endurance, speed, and strength), psychosocial (socioeconomic status, economic situation, educational level, subsidized health regime, family members), and nutritional (dietary habits, food, quantity and type of food and intolerances) variables. A total of 241 variables were analyzed, grouped into 21 groups of variables, of which eight groups were analyzed in depth and showed statistically significant differences. The study had a quantitative approach, correlational study type, and non-experimental cross-sectional design with Bernoulli sampling. The statistical treatment was performed using the statistical program ® version 4.1.0 based on the principal component analysis method, multiple factor analysis, and RV coefficient. It can be evidenced that the profile induced by the position variable correlates with the profile induced by the group of RSA variables. The profile induced by the lower body strength variables correlates with the profile induced by the social variables. The lower body strength variables and the social and family characteristics reveal that players living above 2550 meters of altitude are characterized by having high values in variables such as net strength at 100, 150, and 200 m/s, left-right leg, and vertical peak strength. These are in the subsidized regime and are characterized by living in small families. In contrast, players living at an altitude of 2600 meters were characterized by reaching high levels in variables such as peak power (W/kg), jump height (cm), reactive force index (m/s), eccentric deceleration (N/s/kg), maximum peak velocity (m/s), average concentric force and average eccentric force, characterized by living in more prominent families. Thus, it can be determined that the context of female athletes significantly influences the muscle strength manifestation profile. Finally, the importance of interdisciplinarity in women's soccer is highlighted, seeking to understand that sports performance depends on the interaction of variables. Thus, interdisciplinary research opens a scenario of possibilities where the different variables that influence the sports performance of female soccer players and athletes can be understood under the interactions that occur in the competitive act.

Key Words: training, athletic performance, competition, body composition, nutrition assessment, physical fitness

Introduction

The evolution of sports is closely related to scientific, technological, and research progress (Smolianov et al., 2018), and there is controversy about the changes induced by technology in affecting the development of sport and the manifestation of sports performance (Dyer, 2015). Thus, sports sciences tirelessly seek constant work that allows the interweaving of new methodologies and training systems aimed at the integral improvement of athletes (Pons et al., 2020). In this same line, from 2000 to date, there has been an exponential increase in publications focusing on social and educational outcomes related to youth sports, with soccer being the most researched activity (Schulenkorf, Jerez & Rowe, 2015).

However, many studies have focused on evaluating sports performance based on isolated variables and have yet to consider the correlation of social and educational factors, nutritional habits, and their relationship with morphological and physical variables. This opens the possibility to interdisciplinarity, thus, allowing to glimpse processes in the totality of the human being-sportsman (Pinder, Davids, Renshaw & Araújo, 2011; Tarragó, Massafred-Marimón, Seirul-lo & Cos, 2019). In this way, approaches can be expanded in the relationships of sports talent, training capacity, and of course, the integral performance of the athlete, as an invariable and indeterminable process in time (Balagué Serre, Torrents Martín, Pol Cabanellas & Seirul-lo

Vargas, 2014; Hristovski, Davids, Araújo & Passos, 2011; Becerra Patiño, 2021) that needs to be studied from the non-linear relationships that are established in their environment.

Several studies have investigated the perceived relative importance of psychological and physical factors in the success of sports performance (Pedersen, 2000). Thus, sporting success is mediated by an integration and mutual dependence on physical behaviors, physiological processes, and psychosocial aspects (Gómez-Acosta et al., 2020) that can favor and/or disfavor the athlete, being necessary for an interdisciplinary approach to determine their relationships in every sporting process (Costa, Oliveira, Sena, Lima & Silva, 2018).

On the other hand, it has been found that in Colombia, there are studies aimed at characterizing Colombian soccer players from the psychosocial point of view (Orrego-Ramírez, Velásquez-Restrepo & Uribe-Lopera, 2010), as well as characterizing morphofunctional female soccer players (Becerra Patiño, Sarria Lozano & Prada Clavijo, 2022). Likewise, studies aimed at the study of women's soccer concerning the characterization of neuromuscular processes, morphological and endocrine nature of the player and physical and physiological demand in women's soccer (Becerra Patiño, 2021b), while Becerra Patiño (2021c) has also theoretically conceptualized women's soccer through the study of the dimensions, the female brain as a function of the game, the processes of attention and selection, emotional intelligence and the value of emotions (Becerra Patiño, 2021d).

However, no studies were found to relate morphofunctional and psychosocial, and nutritional variables to their relationship with sports performance. This opens the possibility of developing this research, which aims to respond to this gap in knowledge. As described above, there have been several studies aimed at quantifying the factors related to the prognosis of future sports performance (Johnston, Wattie, Schorer & Baker, 2018), knowing the subjective implicit knowledge of the coach about the perception of future talent (Güllich & Cobley, 2017), the determination of future sports talent from the implementation of physical and technical test batteries in soccer (Rowat, Fenner & Unnithan, 2018) and by assessing physiological, anthropometric and skill attributes (Hoare & Warr, 2000).

Similarly, studies have been developed to determine the effects of training programs to determine the effects of plyometric training in response to positioning (Ospina León, Cárdenas Castiblanco, López Mosquera, Macías Quecán & Becerra Patiño, 2023) and relationships between vertical jumping, linear sprint running and changes of direction in female players (Merino-Muñoz, Vidal-Maturana, Aedo-Muñoz, Villaseca & Pérez-Contreras, 2021). Likewise, some studies have sought to study the effect of the learning model of game experience and fundamental movement skills on psychosocial skills in youth soccer players (Yudando, Suherman, Nugroho & Guntur, 2022).

On the other hand, studies have been developed seeking to apply competency models (MCJF) for the evaluation of soccer players in lower categories (Lazaro, García-Tascon & Gallardo, 2022), concluding that it is necessary to develop research that considers all the variables that influence performance, given that it is a relationship of psychological, technical, tactical and physical processes. However, the different studies developed continue to characterize the performance variables in terms of isolated factors, which does not allow an understanding of the interactions between all the processes that interact in the game (Becerra Patiño, 2020). This opens the door to interdisciplinarity in search of evaluating the correlations established between the female soccer player's physical, morphological, social, educational, and family factors. For this reason, the objective of the present study was to evaluate the association between performance characteristics (morphofunctional) and characteristics (psychosocial and nutritional) in a sample of female soccer players in Bogotá.

Material & methods

Methodology

The present study has a quantitative approach, correlational study type, and non-experimental cross-sectional design (Blasco & Pérez, 2007). It is based on the characterization of the physical, morphological, nutritional, social, personal, family, and educational variables that converge within the sports performance process of women soccer players. This process was developed in two stages. The first step was the application of a structured questionnaire, previously validated by experts, in order to determine the qualitative variables of interest (psychosocial and nutritional variables), on the other hand; several protocols were applied for the morphological and functional assessment of the sportswomen with validated tests and/or instruments. Bernoulli sampling was used. For the statistical treatment, the statistical software ® version 4.1.0 was used.

Participants

A group of 81 female soccer players belonging to the sports process of the Bogotá women's soccer team aged 15-16 years was informed of the scope, possible risks, and requirements to participate in the research. Based on this, informed consent was provided, and the parents signed authorization for the athletes to participate in the study. As they were minors, the athletes signed the informed consent form. The inclusion criteria were: 1) no previous injuries in the last eight months in the lower and/or upper limbs, 2) not to develop any of the two parts of characterization (structured questionnaire or assessment tests), 3) not to train at least three times a week, 4) not to be pre-selected among the players of the Bogotá selection process.

The selected sample was composed of 81 female players, whose characteristics were: an average age of 15.58 (± 0.85 years), a height of 159.4 (± 5.36 cm), and a body mass of 54.55 (± 6.82 kg). Each procedure was

performed according to the principles established by the Helsinki declaration on research on human beings (World Medical Association, 2013). As well as taking as a reference the resolution 8430 of 2003 of the Ministry of Health of Colombia, which establishes the scientific, technical and administrative guidelines for health research using non-invasive procedures. Likewise, the different assessments performed were supervised and supported by the multidisciplinary group of the IDRD (Instituto Distrital para la Recreación y el Deporte) of Bogotá. This team was composed of a physician, physiotherapist, nutritionist, a psychosocial provider, sports psychologist, and biomechanist). The information was collected during three months, between May and July 2021, during the pre-competitive period of Colombia's national women's soccer tournament.

Instruments

The functional variables (strength, endurance, and speed) were determined using different instruments, and a specific warm-up protocol was established for each assessment. Strength was evaluated using PASCO Pasport Force Platform PS-2141 (California, United States) uniaxial platforms, which have a frequency of 1000 Hz. The information provided by the force platform was processed using ForceDecks software, where the most determining variables for the study were: peak power (W/kg), jump height (cm), reactive force index (m/s), eccentric deceleration (N/s/kg), maximum peak velocity (m/s), concentric mean force, eccentric mean force and net hamstring force at 100 m/s, 150 m/s, and 200 m/s. Endurance was evaluated using the Yo-Yo Intermittent Recovery Test Level one (Bangsbo, Iaia & Krustrup, 2008) to determine maximum oxygen consumption and distance covered. Similarly, the Bangsbo Sprint test was used to evaluate the ability to repeat high-intensity actions (RSA), the percentage of fatigue (Bangsbo, 1994). Finally, in speed, distances of 15 and 30 meters and 4x10 meters with a change of orientation were considered. Thus, in both the Bangsbo Sprint test and the speed test, the instrument that evaluated both capacities was the Fitlight Trainer TM wireless reaction system manufactured by Sports Corporation (Ontario, Canada).

For the evaluation of psychosocial characteristics (socioeconomic stratum, economic situation, educational level, subsidized health system, family members) and nutritional characteristics (nutritional habits, eating habits, quantity and type of food, and intolerances), a structured questionnaire was constructed after validation by experts. This was applied online so as not to affect their sports activities. For the collection of information, a calendar of activities was prepared, and the information collected was entered into Microsoft Excel and then processed with the program [®] version 4.1.0.

Procedure

First, the structured form was constructed, and the athletes were grouped into subgroups to facilitate data collection. They were grouped according to their position: goalkeeper (P, n:8), central defender (DC, n:13), lateral defender (DL, n:14), central midfielder (VC, n:18), lateral midfielder (VL, n:11) and forward (DEL, n:17). Each group was accompanied by psychosocial professionals, a sports psychologist, and a nutritionist, seeking to clarify the concerns generated by each question. For the psychosocial and nutritional part, 56 and 109 questions were considered, respectively.

On the other hand, the evaluation of the morphological variable evaluated the somatotype. For this, the Heath & Carter (1990) method was taken into consideration, taking as a reference the Yuhasz protocol, through the measurement of the folds (biceps, triceps, subscapular, supraspinatus, supraspinal, abdominal, thigh and leg, triceps, subscapular, suprascapular, supraspinal, abdominal, thigh and leg), perimeters (wrist, forearm, relaxed arm, contracted arm, thorax, waist, hip, upper thigh, middle thigh, and leg) and diameters (wrist, elbow, knee). A Cescorf 60 anthropometer (Porto Alegre, Brazil) was used to measure short bones, 15 mm pointers, a precision of 1 mm, and an aperture of 154 mm. For skinfold measurements, a Slim Guide Skinfold plicometer (Michigan, United States) was used, which has a capacity of 80 mm and a sensitivity of 1 mm. Thus, the anthropometric measurements were performed in duplicate, taking as a reference the provisions of the International Society for the Development of Kinanthropometry (ISAK) and carried out under the supervision of a certified professional.

Statistical analysis

The multivariate technique was used. The correlation coefficient determined the importance of each group of variables and the relationships within each one. At the same time, the evaluation of synthetic distances of groups employing the MFA and evaluation of the RV statistic for the characterization with the position variable (of related groups). According to the results, measures of relationship with categorical variable (Phi Coefficient or Correlation Ratios) and description of partial representations (Intra Variance) were applied.

Results

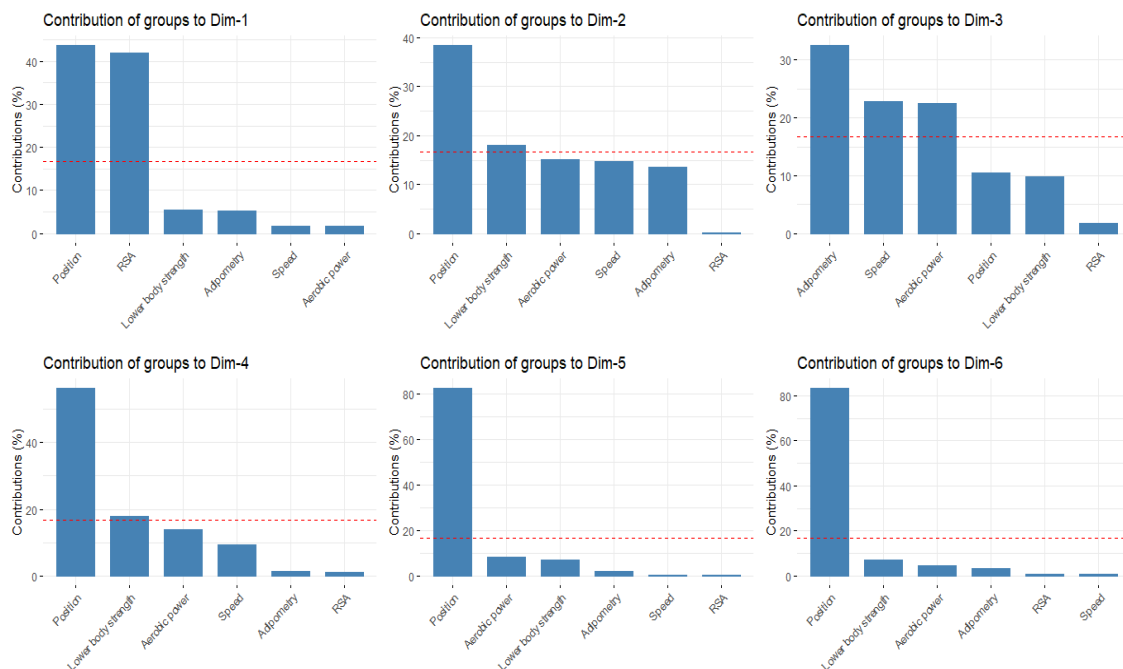
For the grouping of the variables, a consistent and coherent analysis was carried out for the data presented. First, variables were redefined, categories were standardized, and then a total of 241 variables were consolidated. In order to make use of multiple factor analysis (MFA), groups were defined according to the nature of the phenomena evaluated, and the nature of variables. Then eight groups of variables were defined in total, in which statistically significant differences were found. Finally, variable group scenarios were defined according to the researcher's objectives (Table 1).

Table 1. Groups of variables evaluated.

VARIABLE GROUP	VARIABLE SUBGROUP	N° VARIABLES
Adipometry	Adipometry	14
	Classifications	4
Lower body strength	Lower Body Strength	21
	Lunch Characterization	21
	Dinner Characterization	23
Nutritional	Breakfast Characterization	11
	Morning Snack Characterization	14
	Afternoon Snack Characterization	17
	Eating Habits	15
	Nutritional Habits	10
	Food Intolerances	4
Position	Position	1
Aerobic power	Aerobic Power	8
	Training Characterization	8
	Family Nucleus	11
Psychosocial	Social Relationships	21
	Economic Situation	7
	Educational Situation	7
	Social	4
RSA	Sprint Bangsbo	12
Speed	Speed	8
Total number of variables analyzed		241

To facilitate the exercise, we worked with six dimensions (eigenvalues greater than 1) with a cumulative inertia of 53.262%, although the following table shows 69 dimensions within 100%. Likewise, for the analysis by groups and the analysis by contribution, it is interesting to analyze the planes generated by the first three components, in which the position and RSA variables stand out (Figure 1).

Figure 1. Inertia analysis, analysis by groups, and analysis by contribution.



On the other hand, the principal analysis was restricted to the first dimensions for the lower body strength group, so it is necessary to consider high dimensions, such as eight, nine, or ten, in particular. Likewise, the contribution of the group of aerobic power variables in dimension seven is striking. The analysis can be further refined by evaluating the quality of representation. Similarly, the group of variables referring to position has a high dimensionality. At the same time, the groups of lower body strength and aerobic power also have a considerable dimensionality. Finally, the groups of variables with less dimensionality are speed, adipometry, and

RSA in decreasing order, respectively (see Table 2). According to the group of variables and the positions, the Archer position has the least concordance between the profiles generated by the variables.

In this position, what stands out the most are the characteristics of RSA (high values). In the rest of the positions, the profile given by the groups of variables is more concordant with each other. However, the position of central midfielder also stands out for the RSA characteristics. For the analysis by groups and the determination of the RV coefficient, it is determined that, according to the group analysis, the RSA group and the position group are the only ones that have a structural relationship. In sum, the RV coefficient reveals that, in general, the group correlations were low, except for the one for the groups of the previous item (see Table 3). Likewise, the profile induced by the position variable correlates with the profile induced by the group of RSA variables, and the profile induced by the lower train strength variables correlates with the profile induced by the social variables.

Table 2. Analysis by groups and by contribution and analysis by groups and by the quality of representation.

ANALYSIS BY GROUP AND ANALYSIS BY CONTRIBUTION					
	Dim. 1	Dim. 2	Dim. 3	Dim. 4	Dim. 5
Position	43.693058	38.43331458	10.478514	56.341362	82.5612523
Adipometry	5.306392	13.63741973	32.535851	1.405871	1.9375632
Lower body strength	5.575054	18.10699915	9.891502	17.963245	6.8451378
Aerobic power	1.636527	15.03399296	22.488546	13.845733	8.1290147
RSA	41.987922	0.08297187	1.767693	1.019966	0.1912332
Speed	1.801046	14.70530169	22.837894	9.423823	0.3356988
	Dim. 6	Dim. 7	Dim. 8	Dim. 9	Dim. 10
Position	83.3378216	14.9706433	27.5027410	22.394453	17.1587249
Adipometry	3.3462269	3.3944410	10.3486674	12.458408	0.6143086
Lower body strength	7.1651157	14.9649255	34.3345055	24.828088	53.4662989
Aerobic power	4.6633344	63.5969590	2.0563578	11.865628	16.1187693
RSA	0.8431400	0.5398602	0.2697029	1.337368	3.1551505
Speed	0.6443614	2.5332250	25.4880254	27.161054	9.4867479
ANALYSIS BY GROUP AND ANALYSIS BY REPRESENTATION					
	Dim. 1	Dim. 2	Dim. 3	Dim. 4	Dim. 5
Position	0.158058045	6.456647e-02	0.003740023	0.1043388849	1.654709e-01
Adipometry	0.010752519	3.849519e-02	0.1663102442	0.0002997853	4.203389e-04
Lower body strength	0.006369632	3.547388e-02	0.0082494264	0.0262659703	2.815509e-03
Aerobic power	0.000609543	2.715854e-02	0.0473548043	0.0173299686	4.409713e-03
RSA	0.7189199596	1.482153e-06	0.0005242383	0.0001685044	4.372551e-06
Speed	0.0011169239	3.931166e-02	0.0738871961	0.0121460731	1.1377583-05
	Dim. 6	Dim. 7	Dim. 8	Dim. 9	Dim. 10
Position	1.573142e-01	4.167781e-03	1.204334e-02	0.0057797987	2.967426e-03
Adipometry	1.169807e-03	9.882807e-04	7.864729e-03	0.0082836889	1.754296e-05
Lower body strength	2.878422e-03	1.030855e-02	4.646021e-02	0.0176559011	7.131724e-02
Aerobic power	1.354077e-03	2.067584e-01	1.850798e-04	0.0044784407	7.198468e-03
RSA	7.930910e-05	2.668945e-05	5.704352e-06	0.0001019345	4.941856e-04
Speed	3.911334e-05	4.963108e-04	4.301795e-02	0.0355021241	3.772478e-03

Table 3. Analysis by groups of variables, coefficient RV of the variable group.

GROUP 1	GROUP 2	RV
Position	RSA	0.306299*
Lower body strength	Social characteristics	0.205567*
Lower body strength	Family nucleus	0.173501
Position	Economic situation	0.146092
Aerobic power	Breakfast characteristics	0.138865
Aerobic power	Morning refrigerator characteristics	0.135942
Speed	Food intolerances	0.133428
Speed	Eating habits	0.126996
Aerobic power	Afternoon snack characteristics	0.123774
RSA	Classifications	0.085397
Aerobic power	Speed	0.07355

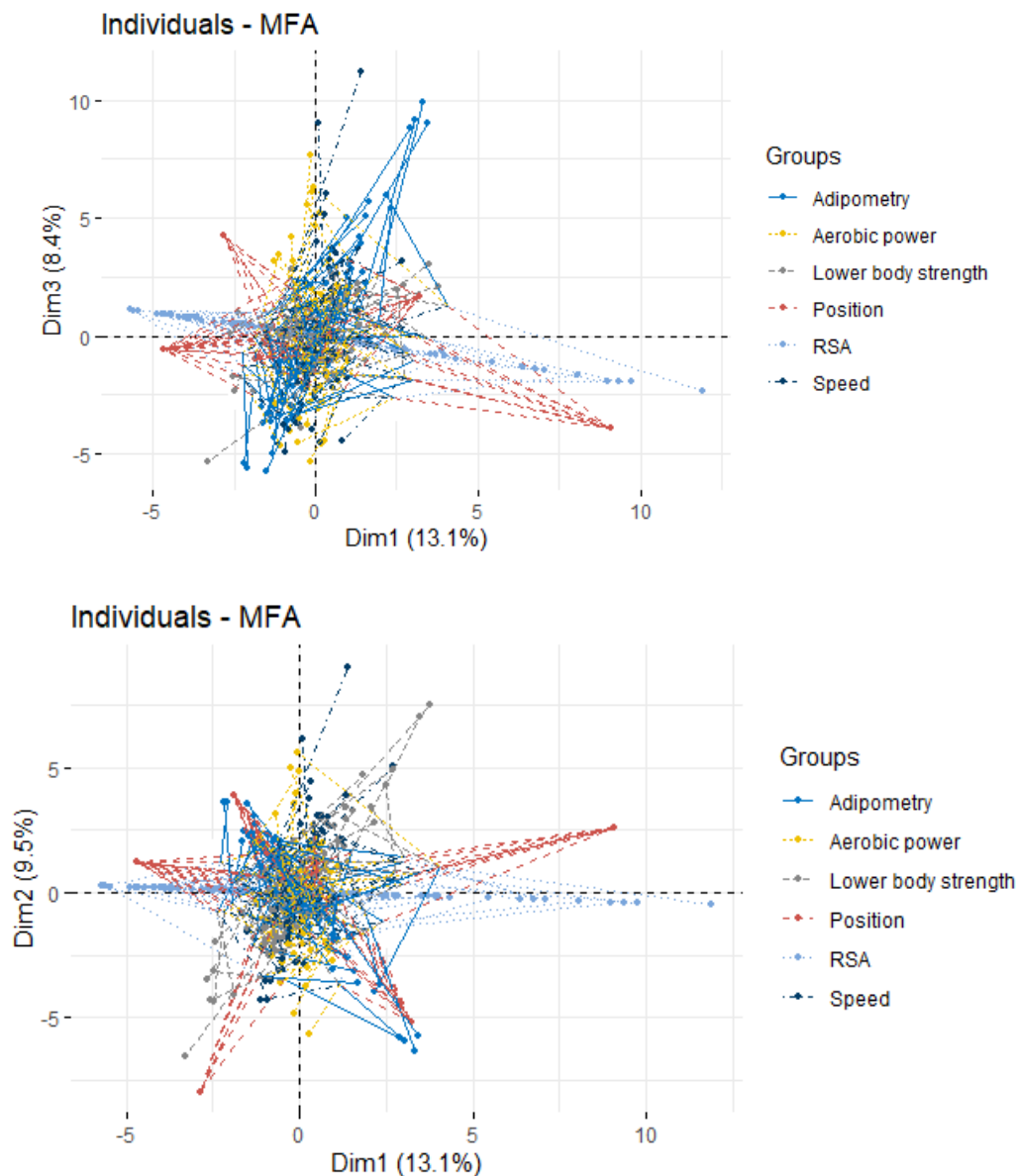
* Statistically significant differences exist

Taking into account the associations of interest and that the characterization focuses on the groups of variables related to sports performance, the groups were arranged as follows: active variables (Position, RSA, lower body strength, aerobic power, and speed) and supplementary variables (Social, family nucleus, economic situation, breakfast-lunch-dinner characteristics, eating habits, adipometry and educational situation). In another instance, for the associations of interest according to the correlation coefficient RV, it is established that: the profile induced by the position variable has a correlation with the profile induced by the group of RSA variables (RV: 0.30), the profile induced by the lower body strength variables, has a correlation with the profile induced

by the social variables (RV: 0.20) and the family nucleus (RV: 0.17) and the position profile has a correlation with the economic situation (RV: 0.14). In order to determine the characterization of the profiles and taking into account the associations of interest, and that the characterization focuses on the groups of variables related to sports performance, the groups were arranged as follows: a group of active variables (Position, RSA, lower body strength, aerobic power, and speed) and a group of supplementary variables (social, family nucleus, economic situation, breakfast-lunch-dinner characteristics, eating habits, adipometry, somatotype classifications, and educational situation).

For the analysis by groups in the partial representation, the strong vertices are the players' positions (active variable). The representations of each of the groups were evaluated (figure 2).

Figure 2. Multiple factor analysis and groups of active variables in the 81 female players.



According to the group of variables and the positions, it is observed that the position with the lowest concordance between the profiles generated by the groups of variables is the goalkeeper position. In this position, what stands out the most are the low levels in the characteristics of RSA, while in the rest of the positions, the profile given by the groups of variables is more concordant with each other. However, the position of central midfielder is the one that stands out the most in RSA. For dimension one, it is observed that the positions: goalkeeper and central midfielder presented the most significant variability, and, at the same time, for dimension three, the positions with the most significant variability were: goalkeeper, central defender, and side midfielder.

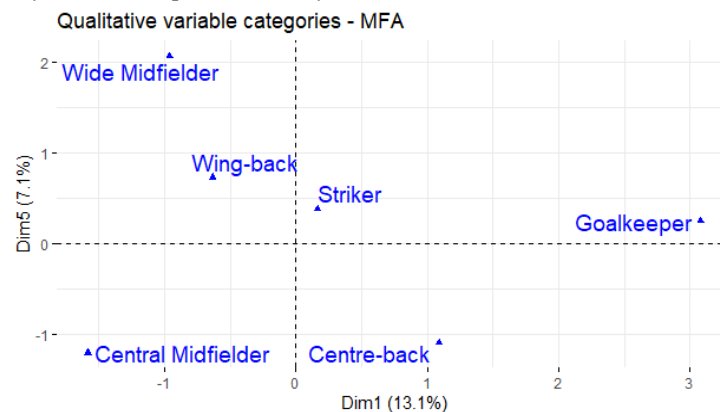
Within the characterization of the profiles, the analysis of dimensionality and quality of representation of supplementary variables, the importance of the associations between the different variables: position, nutritional characteristics, social, and morphofunctional characteristics are highlighted (table 4).

Table 4. Profile characterization and dimensionality analysis and profile characterization and quality of representation analysis for supplementary variables (MFA) multiple factor analysis.

	Position		Lower body strength			Aerobic power		RSA		
	5.000000		2.019973			1.818878		1.015149		
	Speed		Adipometry			Lunch Characterization		Dinner Characterization		
	1.202231		1.084052			3.614082		3.999090		
	Breakfast characteristics		Classifications			Nutritional Habits		Family Nucleus		
	4.834652		4.108473			5.091029		2.501191		
	Economic situation		Educational status			Social characteristics		MFA		
	5.329290		1.316431			8.431754		3.631058		
	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5	Dim.6	Dim.7	Dim.8	Dim.9	Dim.10
Adipometry	0.00163	0.00012	0.00001	0.00021	0.00054	0.00326	0.00010	0.00055	0.00006	0.00336
Lunch C.	0.00283	0.00393	0.00606	0.00191	0.00131	0.00361	0.00245	0.00151	0.00438	0.00358
Dinner C.	0.00228	0.00591	0.00359	0.00461	0.00365	0.00722	0.00100	0.00177	0.00350	0.00260
Breakfast C.	0.00192	0.00996	0.01074	0.00222	0.00342	0.00511	0.00419	0.00416	0.00246	0.00203
Classifications	0.00455	0.00160	0.00054	0.00133	0.00138	0.00734	0.00263	0.00153	0.00075	0.00292
Nutritional Habits	0.00474	0.00435	0.00630	0.00287	0.00504	0.00345	0.00419	0.00406	0.00672	0.00529
Family Nucleus	0.00076	0.00651	0.00144	0.00170	0.00180	0.00194	0.00204	0.00129	0.00255	0.00247
Economic situation	0.00304	0.00705	0.00293	0.00290	0.00360	0.00560	0.00112	0.00093	0.00197	0.00291
Educational status	0.00142	0.00078	0.00021	0.00004	0.00083	0.00193	0.00054	0.00016	0.00035	0.00124
Social characteristics	0.004077	0.003530	0.001196	0.005305	0.004690	0.005130	0.003862	0.00385	0.003253	0.00737

Finally, the position variable has a good contribution in dimension one, a superior quality of representation in dimension one, and a high dimensionality (see Figure 3).

Figure 3. Position analysis and multiple factor analysis.



Discussion

The study's main objective was to evaluate the association between performance characteristics (morphofunctional) and characteristics (psychosocial and nutritional) in a sample of female soccer players in Bogota. The results showed that several variables influence the morpho-functional characteristics of the players, and two profiles were determined according to the sociodemographic context. Firstly, a manifestation centered on the hamstring strength of both legs and high net peak vertical strength for those contexts (2550-2560 meters of altitude). In contrast, the players who live in contexts close to 2600 meters of altitude show a better peak power capacity, jump height, reactive strength index, eccentric deceleration, maximum peak velocity, and concentric-eccentric average strength. Likewise, these findings confirm that there are relationships between morphofunctional characteristics, mainly between the profile induced by the position variable with the profile induced by the RSA group of variables (RV: 0.30), the lower body strength variables with the profile induced by the social variables (RV: 0.20) and the family nucleus (RV: 0.17) and the position correlates with the economic situation (RV: 0.14). Previous studies have yet to be found in women's soccer, allowing us to compare the results obtained in the present study. However, there are some similarities based on multivariate analyses for the study of performance in roller field hockey (Arboix-Alió et al., 2022), approaches that evidence the importance of interdisciplinarity in sport. For everything described above, the training process must expand its horizons and begin to rethink how the social (Travassos, Araújo, Correia & Esteves, 2010) (Pain & Harwood, 2008; Ribeiro, Silva, Duarte, Davids & Garganta, 2017) and nutritional context (Gibson, Stuart-Hill, Martin & Gaul, 2011) play a determining role in sports performance. Those performance improvements are not only associated with the preparation process itself but with the complexity of the athlete's adaptive systems (Seifert, Araújo, Komar & Davids, 2017; García Manso, Martín González & Da Silva, 2010).

The main criticism lies in understanding that research in sports sciences has evolutionarily been monodisciplinary. Hence, the study developed by Piggot, Müller, Chivers, Papaluca & Hoyne (2019) asks an interesting question about whether "Is sports science responding to the call of interdisciplinary research?" Concluding that interdisciplinary studies and individual analyses constantly argue with the theory of constraints, seeking to predict and explain sports performance from the variables that interact with each other in athletes. Furthermore, this means sports science research is beginning to play an integrative role in response to the call for interdisciplinary research (Fargier, Collet, Moran & Massarelli, 2016).

Therefore, it is necessary to refer that there are studies that seek to relate interdisciplinarity in soccer (Arjun, 2007), expanding the horizons of research and the scope of the findings for improving the sport and the athlete. Accordingly, one study aimed to establish opportunities for interdisciplinarity in the management of musculoskeletal injuries in soccer by incorporating psychology and nutrition (Rollo et al., 2021). In another study, an interdisciplinary approach to understanding performance in Australian soccer through quantification of individual characteristics and representative task design was further explored, concluding that through interdisciplinary research, a complete understanding of sports performance is enabled (Piggot, Müller, Chivers, Cripps & Hoyne, 2020).

However, studies addressing interdisciplinarity in women's soccer still need to be completed. In sum, some studies suggest dietary habits for female soccer players. Thus, the study developed by Dobrowolski, Karczemna & Wlodarek (2020) indicates that the individual adjustment of the energy value of the diet is the crucial factor for the physical performance of female athletes. Data confirmed in the present research, where the quality of food and nutritional habits of the players seems to be sensitive to the development and manifestation of high aerobic power and speed in the group of players evaluated in the present study. The players who eat breakfast early in the day are associated with better levels of maximum oxygen consumption and distance run variables. Likewise, they consume few or no portions of foods such as cereals, bread, eggs, cheese, and fried foods. Likewise, the determination of energy requirements responds not only to the basal metabolic rate and thermogenesis produced by the diet, given the need inherent to the demands of the competition for each athlete (Burke, 2001). For this reason, the present study reinforces that nutritional aspects depend on other processes of the athlete. The association of the related variables of the present study shows the following correlations: aerobic power-breakfast characteristics (RV: 0.13), aerobic power-morning snack characteristics (RV: 0.13), speed-food intolerance (RV: 0.13), speed-food habits (RV: 0.12) and aerobic power-afternoon snack characteristics (RV: 0.12). Another study determined that functional movement patterns might also be relevant to the ability to repeat high-intensity actions (RSA), indicating the potential success of young male soccer players (Campa, Semprini, Júdeice, Messina & Toselli, 2019). Similar to the results of the present study, where significant associations of RSA were found with the sport performance of female soccer players. The central midfielders and wingers have the highest capacity to repeat high-intensity actions, and the central defenders and goalkeepers have the lowest capacity. On the other hand, the study developed by Lazaro et al. (2022) shows that the evaluations of the competencies of the psychological, tactical, technical, and physical areas of youth players differ from those perceived by coaches, which leads to the need to continue thinking about strategies to understand how the different capabilities are related in athletes. To this end, this type of research that relates the variables in response to the context of each athlete, understanding their sports and nutritional habits, as well as the psychological factors associated with sports practice, can favor the understanding of the player as an agent in constant change.

Conclusions

The variables of lower body strength and the social and family characteristics reveal that the players who live above 2550 meters of altitude are characterized by having high values in variables such as net strength in 100, 150, and 200 m/s, in the left-right leg, in vertical peak strength. These are in the subsidized regime and are characterized by living in small families. While, the players living at an altitude of 2600 meters were characterized by achieving high levels in variables such as peak power (W/kg), jump height (cm), reactive force index (m/s), eccentric deceleration (N/s/kg), maximum peak speed (m/s), average concentric force and average eccentric force, being characterized by living in more prominent families. Thus, it can be determined that the context of female athletes significantly influences the muscle strength manifestation profile.

For the position and RSA association, the central and wing midfielders have the most significant capacity to repeat high-intensity actions. In contrast, the central defenders and goalkeepers have the lowest capacity. The quality of food and nutritional habits of the players is sensitive to the development and manifestation of high aerobic power in the group of players evaluated in this study. The interdisciplinary research opens a scenario of possibilities where the different variables that influence the sports performance of the female soccer player and the sportswoman can generally be understood under the interactions that occur in the competitive act. The findings of this research are the first input that sought to analyze how various morphological, functional, psychosocial, and nutritional variables are related. Therefore, opening new research scenarios that help to understand how the different variables that interact synergistically in any sporting process are related. This is because when evaluating that there are variables in which significant relationships were not found and others in which they were, the research should help clarify the contribution of the object of study of interdisciplinarity, especially in women's and men's soccer.

Recommendations

The process of sports preparation in search of performance needs much more research, considering the integration of inter and transdisciplinarity to provide solutions to the problems and opportunities presented by the "real practice of training-competition".

Conflicts of interest

The authors have no conflict of interest

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