Familial Aggregation of Physical Activity Levels: A Study with Families From Northeast of Portugal.

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Abstract

Physical activity (PA) lifestyle is known to have significant health benefits. Familial resemblance reflecting genetic and environmental factors shared by family members could be an important determinant of habitual PA levels. However, in the literature the results in familial resemblance are controversial.

Purpose: to analyze familial resemblance in habitual PA, sport participation, and sedentary behavior.

Methods: sample comprised 1136 individuals from 284 families (284 parents and 284 sibling pairs). The offspring were 6 to 19 years old (14±2.30). All the families live in the northeast region of Portugal. PA was evaluated with two questionnaires: IPAQ short version and Baecke et al. (1982). Intra-familial correlations and heritability were calculated respectively with FCOR and ASSOC routines from S.A.G.E. 5 software package.

Results: In the habitual PA and sport participation indicators the correlations between spouses are higher (0.26 to 0.52) than between parents and offspring (0.08 to 0.24), and between siblings (0.13 to 0.51). In inactivity indicator the correlations are identical between all family relationships (0.31 to 0.40). The heritability values are all significantly different from zero ($P<0.05$) and vary between 0.14 and 0.42 in PA and sport participations indicators. In physical inactivity $h2 = 0.49$.

Conclusion: These results suggest that families tend to resemble in habitual PA, sport participation and in sedentary behavior. The pattern of correlations found is indicates that the environment factors have more influence than genetic factors in PA and sport participations. It seems that sedentary behavior is more genetic dependent than habitual PA and sport participation.

Introduction

There is a strong agreement in the scientific community that physical activity (PA) positively influences individual health status, both in children (Strong et al., 2005) and adults (Bouchard e Deprés, 1995; Brown et al., 2004). Regular PA is an important factor to promote a healthy lifestyle along the whole life cycle, although some studies have shown that sedentary behaviour is increasing in children and adolescents, who spend a large part of their free leisure time in sedentary activities (Fontvieille et al., 1993; Reilly et al., 2004).

The main purpose in the psychosocial determinants of physical activity is to identify the mechanisms that control the behaviour of individuals. It is assumed that with the knowledge of these mechanisms it is possible to design interventions programs to promote physical activity. Although, this research paradigm only have found explanation of about 20 to 30% of physical activity variability.

Another important research paradigm is the genetic epidemiology of physical activity. The study of family members in physical activity is an important methodology to deduce about the genetic and environmental factors in physical activity adherence.

Families are the core to children general education and could act an important role to children physical activity adherence.

Purpose

The purpose of this study was to analyze familial resemblance in habitual PA, sport participation, and sedentary behavior.

Sample

The sample comprised 1136 individuals from 284 families (284 parents and 284 sibling pairs). The offspring were 6 to 19 years old (14±2.30). All the families live in the northeast region of Portugal.

Methods

Physical Activity assessment

Two questionnaires were used:

IPAQ short form:

- Questions about three specific types of physical activity domains and sitting:
  - walking (WPA), moderate-intensity activities (MPA) and vigorous intensity activities (VPA); frequency (measured in days per week) and duration (time per day) are collected separately for each specific type of activity.
- The IPAQ sitting question (SQ) is an additional indicator variable and is not included as part of any summary score of physical activity.
- The results in each physical activity level are in MET. The global result (METwk) is in MET*week*min^{-1}.

Beacke et al. (1982):

- The questionnaire has a year as reference.
- Three physical activity indexes are calculated:
  - Work index (WI)
  - Sport index (SI)
  - Leisure-time index (LI)

Statistical Procedure

Intra-familial correlations and heritability were calculated respectively with FCOR and ASSOC routines from S.A.G.E. 5 software package.

Results

Familiar correlation±se in SI and LI from Beacke questionnaire

Relationships	# pairs	SI	LI
Parents – Siblings	1053	0.075±0.036	0.240±0.036
Siblings	268	0.126±0.057	0.248±0.055
Mãe – Pai	259	0.299±0.056	0.377±0.054
Father – Sister	301	0.199±0.061	0.105±0.065
Father – Son	215	0.030±0.066	0.358±0.063
Mother – Daughter	312	0.150±0.061	0.247±0.061
Mother– Son	225	-0.055±0.065	0.328±0.063
Brother – Brother	45	-0.121±0.146	0.341±0.133
Sister – Sister	86	0.306±0.105	0.441±0.093
Brother – Sister	137	0.038±0.089	0.195±0.085

Heritability (h^2) and standard errors (SE)

	h^2	±SE	p
SI	0.146	±0.056	0.010
LI	0.395	±0.051	<0.001
VPA	0.233	±0.093	0.012
MPA	0.419	±0.078	<0.001
WPA	0.221	±0.065	<0.001
METwk	0.225	±0.059	<0.001
SA	0.487	±0.055	<0.001

Familiar correlation±se in SI and LI from IPAQ questionnaire

Relationships	# pairs	VPA	MPA	WPA	METwk	SQ
Parents– Siblings	1053	0.081±0070	0.178±0063	0.019±0049	0.131±0046	0.346±0041
Siblings	268	0.421±0070	0.505±0060	0.248±0063	0.365±0054	0.397±0053
Mother – Father	259	0.516±0052	0.436±0059	0.466±0067	0.263±0106	0.309±0108
Father – Daugther	301	0.413±0063	-0.073±0000	0.179±0081	0.179±0107	0.051±0118
Father – Son	215	0.0319±0068	0.054±0076	0.081±0089	0.119±0115	0.006±0115
Mother – Daugther	312	0.393±0063	0.213±0072	0.252±0075	0.230±0100	0.230±0122
Mother – Son	225	0.281±0067	0.160±0075	-0.058±0083	0.212±0111	-0.001±0145
Brother - Brother	45	0.203±0168	0.044±0153	0.001±0174	0.141±0178	0.292±0186
Sister – Sister	86	0.578±0081	0.466±0100	0.415±0108	0.571±0105	0.601±0118
Brother – Sister	137	0.450±0075	0.421±0077	0.224±0095	0.586±0081	0.432±0108

Discussion and Conclusion

In the habitual PA and sport participation indicators the correlations between spouses are higher (0.26 to 0.52) than between parents and offspring (0.08 to 0.24), and between siblings (0.13 to 0.51). Simonen et al. (2002) also found higher correlations between the parents (0.14 a 0,43) than between siblings (-0.06 a 0.10).
In the indicator of sedentary activity the correlations are identical between all family relationships (0.31 to 0.40).
The heritability values are all significantly different from zero ($P<0.05$) and vary between 0.14 and 0.42 in physical activity and sport participations indicators. These heritability values are similar to the heritability values found by Pérusse et al. (1989), they found that the genetic factors explain 29%.
In sedentary activity $h^2 = 0.49$.

Conclusion: These results suggest that families tend to resemble in habitual PA, sport participation and in sedentary behavior. The pattern of correlations found indicates that the environment factors have more influence than genetic factors in PA and sport participations. It seems that sedentary behavior is more genetic dependent than habitual PA and sport participation

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Results

Mean±sd

	Siblings		Pais	
	Girls	Boys	Mother	Father
IPAQ				
VPA	1000±2,5	1584,8±2,5	1586,8±3,1	3162,2±3,1
MPA	398,1±2,5	630,9±3,1	794,3±3,1	1000±3,1
WPA	501,1±2,5	501,1±3,1	630,9±3,1	794,3±3,9
METwk	1584,8±2,5	1995,8±2,5	1584,8±3,9	3162,2±3,9
Beacke				
SI	2,5±0,5	2,6±0,5	1,9±0,5	2,1±0,6
LI	3,1±0,6	3,2±0,5	2,6±0,5	2,6±0,6