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RESEARCH ARTICLE

Sociodemographics, playing habits, adherence to the Mediterranean dietary pattern, dietary supplements intake, physical activity level, and degree of Internet gaming disorder of Portuguese chess players

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➤ Sociodemographics, playing habits, adherence to the Mediterranean dietary pattern, dietary supplements intake, physical activity level, and degree of Internet gaming disorder of Portuguese chess players

ABSTRACT

Introduction: Lifestyle and gaming habits may influence chess players' adherence to healthy dietary patterns. This study aims to characterize Portuguese chess players sociodemographics, playing traits, adherence to the Mediterranean diet (MD), dietary supplement (DS) consumption, physical activity level, degree of internet gaming disorder (IGD) and to study predictors of adherence to the MD.

Methodology: Data was gathered using an online survey disseminated through social networks, which included questions regarding sociodemographics, chess playing habits, the PREDIMED questionnaire, DS consumption, the International Physical Activity Questionnaire, and the Internet Gaming Disorder Scale.

Results: The 192 respondents (93.8% males) had a mean of 41 years (SD=14), high education (mean=15.1 years; SD=1.7), and played chess for 6.3 hours (SD=9.7) a week. Most (58.9%; n=113) reported moderate adherence to the MD, 30.2% (n=58) ingested DS, 64.1% (n=123) adhered to the WHO Physical Activity Recommendations, and no subject was classified with IGD.

Higher Elo scores correlated with higher red/processed meat consumption (OR=4.935, p=0.005). A greater volume of chess play related to higher consumption of pastries and sweets (OR=3.127, p=0.007). Higher IGD scores were associated with lower adherence to the MD (OR=1.067, p=0.019).

Conclusions: The most dedicated chess players may be less concerned with maintaining a balanced diet and may require supervision from health professionals.



PALABRAS CLAVE

Juegos de Vídeo;
Suplementos
Dietéticos;
Dieta Mediterránea;
Conducta
Sedentaria;
Trastorno de
Adicción a Internet.

> Sociodemografía, hábitos de juego, adherencia al patrón dietético mediterráneo, ingesta de suplementos dietéticos, nivel de actividad física y grado de trastorno del juego en Internet de jugadores de ajedrez portugueses

RESUMEN

Introducción: El estilo de vida y los hábitos de juego pueden influir en la adhesión de los jugadores de ajedrez a patrones dietéticos saludables. Este estudio pretende caracterizar la sociodemografía de los ajedrecistas portugueses, sus rasgos de juego, su adherencia a la dieta mediterránea (DM), el consumo de suplementos dietéticos (DS), el nivel de actividad física, el grado de trastorno de los juegos de Internet (IGD) y estudiar los predictores de la adherencia a la DM.

Metodología: Los datos se recolectaron mediante una encuesta en línea difundida a través de redes sociales, que incluyó preguntas sobre datos sociodemográficos, hábitos de juego de ajedrez, cuestionario PREDIMED, consumo de DS, Cuestionario Internacional de Actividad Física y Escala de Trastorno de los Juegos de Internet.

Resultados: Los 192 encuestados (93,8% hombres) tenían un promedio de 41 años (DE=14), educación alta (media=15,1 años; DE=1,7), y jugaban al ajedrez 6,3 horas (DE=9,7) por semana. La mayoría (58,9%; n=113) refirió una adherencia moderada a la DM, 30,2% (n=58) ingirió DS, 64,1% (n=123) adhirió a las recomendaciones de actividad física de la OMS y ninguno fue clasificado con IGD. Puntuaciones Elo más altas se relacionarán con un mayor consumo de carne roja/procesada (OR=4,935; p=0.005). Un mayor volumen de juego de ajedrez se relacionó con un mayor consumo de repostería comercial (OR=3,127; p=0.007). Puntuaciones más altas de IGD se asociaron con una menor adhesión a la DM (OR=1,067; p=0.019).

Conclusiones: Los jugadores de ajedrez más dedicados pueden estar menos preocupados por mantener una dieta equilibrada, y pueden requerir supervisión de profesionales de la salud.

KEY
MESSAGES

1. Our sample register a lower consumption of fruits and vegetables, higher red or processed meat intake, and remain seated for longer hours a day than a reference population.
2. A higher level of chess skill or dedication correlated with inadequate dietary habits.
3. The most consumed dietary supplements were multivitamins-minerals with the purpose of increase energy/decrease fatigue and maintain good health.

CITATION

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INTRODUCTION

Chess originated about 1,500 years ago, and the number of players has been increasing in recent years. Netflix's "The Queens Gambit" and the COVID-19 pandemic have led to increased online chess competition and video sharing on Twitch and YouTube¹.

While sports nutrition research has typically focused on the most physically taxing sports such as athletics², mind sports received less attention. Chess relies on cognitive domains such as fluid and crystallized intelligence, processing speed, and short-term memory³, and has been recognized as a sport by the International Olympic Committee since 2004⁴.

In order to get an edge over opponents chess players may resort to "smart drugs" and stimulating DS such as caffeine to boost their cognitive abilities and minimize fatigue⁵. However, this practice has been considered a menace to the fair play policy in chess⁶, and DS consumption represents a potential health hazard⁷.

Sedentarism⁸, inadequate dietary habits, and obesity are all linked to decreased cognitive function, in part due to raised neuroinflammation⁹.

The rise in online chess websites¹ may be escalating the prevalence of IGD, linked to poor physical and cognitive health, sleep disturbances, and inadequate diet, including excessive caffeine consumption¹⁰.

In contrast, a healthy lifestyle that includes physical activity⁸, an adequate BMI, and adherence to a balanced diet (e.g., Mediterranean diet)⁹ correlates with optimal cognition.

Fornal-Urban *et al.*'s 2008 study on Polish elite chess players found that 41.1% skipped breakfast, only 13.3% ate fruit and vegetables daily, and 57.2% consumed sweets daily¹¹.

Justified by the scarcity of scientific literature, this investigation's main objectives were to characterize Portuguese chess players' sociodemographics, playing traits, adherence to the MD, DS consumption, physical activity level, degree of IGD, and to study the predictors of adherence to the MD.

METHODOLOGY

Study Design

This research project complied with the Declaration of Helsinki of the World Medical Association and received approval from

an ethics committee of the University of Porto (No. 82/2022/CEFCNAUP/2022). An online survey was applied to a convenience sample of chess players between 1 July 2022 and 30 September 2022 by email, on chess-related websites, and Facebook pages and groups.

Inclusion criteria

Participants in this cross-sectional study had to be adult Portuguese chess players resident in Portugal, aged 18 to 69 and had played the game for at least six months. There were no rewards for taking part.

Survey administration

The survey was applied through Google form and is available as supplementary material (SM1). The survey's design, execution, and report adhered to the CHERRIES checklist statement¹², also provided as a supplement (SM2).

230 participants completed the questionnaire, 38 were excluded due to failure to comply with inclusion criteria or incoherent data, and 192 were included.

Questionnaires included

The survey included questions related to socioeconomic level¹³, weight and height, chess playing habits, the PREDIMED questionnaire^{14,15}, DS consumption¹³, the International Physical Activity Questionnaire - Short Form (IPAQ-SF), and the Internet Gaming Disorder Scale - Short-Form (IGDS9). The PREDIMED, IGDS9, and IPAQ-SF have been previously validated in the Portuguese population.

Corrective equations for BMI were applied to compensate for misestimated weight and height¹⁶. BMI (kg/m²) was classified according to the World Health Organization cut-offs¹⁷. Permission for the use of PREDIMED (www.predimed.es) and IGDS9 were granted.

Statistics

Descriptive statistics were produced for all variables. Skewness and kurtosis were used to evaluate the normality of quantitative variables, and all had a distribution close to the normal, that is, between -1 and 1 for both coefficients.

Binary logistic regression models were applied to study the predictors of overall low (< median) adherence to the MD style and non-compliance with each of the 14 items evaluated by PREDIMED. Independent variables included: sex, age, BMI, physical activity level, weekly hours of chess practice, number of chess competitions in the prior 12 months, number of years of chess practice, Elo score, registration in the Portuguese

Chess Federation (FPX), and total IGD score. The independent variables included in the regression models were tested for multicollinearity, and all variance inflation factor values (using dummy variables for categorical ones) were below 2.6. For the overall adherence to the MD style, both univariate (raw) and multivariate (adjusted) models are presented, while for individual items we present the adjusted models.

Fisher's exact test was used to assess the independence between DS use and sex, marital status, and employment status. The comparison between participants who did vs. those who did not use DS was performed using independent samples T-test for age, BMI, and household size and Mann-Whitney's test for education and income.

The significance for all analyses was established at 5%. SPSS® Statistics 28.0 for Windows was used for all statistical analysis (IBM Corp., Armonk, NY, USA).

RESULTS

Sociodemographics and BMI

The 192 participants averaged 41.1 years (SD=14), had a BMI of 26.2 kg/m² (SD=4.3), and were predominantly male (93.8%; n=180), with a high education level (mean=15.1 years; SD=1.7). Lisbon was home to 27.6% (n=53), and 21.9% (n=42) lived in Porto city.

Additional information is detailed in Table 1.

Chess-related variables

The subjects have been playing chess for a mean of 21.1 years (SD=15.1) and averaged 6.3 hours (SD=9.7) of chess practice per week. 64.6% (n=124) were registered in the FPX. 66.1% (n=127) reported having an Elo Score, with a mean score of 1679 (SD=306), and 68.2% (n=131) participated in at least one chess competition in the prior 12 months, with an average of 6.2 (SD=8.0) chess competitive events.

PREDIMED and Dietary Habits

Our sample had a mean total PREDIMED score of 7.0 (SD=1.7). 24.5% (n=47) of participants were classified as having weak adherence, 58.9% (n=113) moderate-to-fair adherence, and 16.7% (n=32) had good or very good adherence to the MD. In total, 75.0% (n=144) of the sample ingested less than five portions of fruit and vegetables a day, while the daily consumption averaged 3.3 servings (SD=1.9).

Table 1. Sociodemographic characteristics.

	%	n
Sex		
Male	93.8	180
Female	6.3	12
Age		
18 to 29 years	24.5	47
30 to 39 years	20.8	40
40 to 49 years	26.6	51
50 to 59 years	16.7	32
60 to 69 years	11.5	22
BMI		
Underweight (BMI < 18.5 kg/m ²)	2.6	5
Normal range (BMI ∈ [18.5; 25.0] kg/m ²)	41.7	80
Pre-obesity (BMI ∈ [25.0; 30.0] kg/m ²)	35.9	69
Obesity class I (BMI ∈ [30.0; 35.0] kg/m ²)	16.7	32
Obesity class II (BMI ∈ [35.0; 40.0] kg/m ²)	3.1	6
Education		
9 years	2.1	4
12 years	16.7	32
14 years	4.7	9
≥16 years	76.6	147
Household income^a		
Low (<1456 €)	21.4	36
Middle (1456 to 2910 €)	48.8	82
High (>2910 €)	29.8	50
Marital status		
Married or living in a de facto relationship	52.1	100
Single	40.1	77
Divorced	7.8	15
Employment status		
Worker	77.6	149
Unemployed	4.7	9
Other	17.7	34

^a23 participants didn't report household income.

Compliance with each PREDIMED item is presented in Table 6, available as supplementary material ([SM3](#)).

Dietary Supplements

From our total initial sample (n=192), 30.2% (n=58) reported having ingested DS supplements in the prior 12 months. Multivitamin-mineral complexes (41.4%; n=24) and whey protein (31.0%; n=18) were the most consumed type of supplement (Table 2).

The main reasons reported for consuming DS were to increase energy/decrease fatigue (44.8%; n=26), maintain good health (44.8%; n=26), prevent/treat diseases or injuries (36.2%; n=21) (Table 3).

Nearly one third of DS consumers (31.6%; n=18) cited medical doctors as a source of information regarding DS, followed by scientific articles (24.1%; n=14). The majority of the DS consumers (29.3%; n=17) in this sample purchased their DS in supplement stores/herbalists, followed by online stores (27.6%; n=16).

Most DS users reported being very well (27.6%; n=16) or well-informed (34.5%; n=20) about DS.

Only the employment status had a statistically significant relationship with supplement intake (p=0.005), with DS users presenting a slightly higher proportion of active workers and no unemployed. Additional information regarding DS consumption is available as supplementary material ([SM4](#)).

Physical Activity Level

On the IPAQ-SF, 45.8% (n=88) of respondents were classified as having a high, 33.3% (n=64) moderate, and 20.8% (n=40) low physical activity level. According to the stated data, 64.1% (n=123) of respondents adhere to the WHO Physical Activity Recommendations, while 35.9% (n=69) don't. Regarding sedentary behavior, our sample averaged 6.4 (SD=0.2) daily hours of sitting.

IGD

The sample averaged 13.5 points (SD=5.4) on the IGDS9. No respondent accumulated a total score ≥ 36 , and thus no subject was classified as presenting IGD.

Logistic regression results

Sex: The chances of non-compliance regarding vegetable intake (OR=0.157; p=0.026) were lower, and the use of olive oil as the main cooking fat (OR=22.243; p \leq 0,001) were higher for females compared to males (Table 7, [SM3](#)).

Table 2. Types of dietary supplements consumed.

	%	n
Multivitamin/mineral complex	41.4	24
Whey protein	31.0	18
Sports bars	29.3	17
Magnesium	29.3	17
Omega 3	24.1	14
Caffeine	19.0	11
Vitamin C (ascorbic acid)	17.2	10
Sports drinks	13.8	8
Energy drinks	13.8	8
Creatine	13.8	8
Vitamin D ₃ (cholecalciferol)	12.1	7
Vegetable protein (soy pea rice)	10.3	6
Vitamin B ₁₂ (cobalamin)	10.3	6
Calcium	8.6	5
Gingko biloba	8.6	5
Glucosamine	8.6	5
Carbohydrates	6.9	4
Complex B vitamins	6.9	4
BCAAs	5.2	3
Chondroitin	5.2	3
Brewer's yeast	5.2	3
Vitamin E	5.2	3
Essential Amino Acids	3.4	2
Iron	3.4	2
Glutamine	3.4	2
Guarana	3.4	2
L-carnitine	3.4	2
Potassium	3.4	2
Flavonoids	1.7	1
Ginseng	1.7	1
Iodine	1.7	1
Lysine	1.7	1
Nitrates / Beetroot Juice	1.7	1
Vitamin B ₃ (niacin)	1.7	1
Zinc-selenium	1.7	1

Table 3. Reasons for using dietary supplements.

	%	n
Increase energy/decrease fatigue	44.8	26
Keep me healthy	44.8	26
Prevent/treat illness or injury	36.2	21
Gain muscle mass	27.6	16
Improve sports performance	24.1	14
Improve cognitive performance	19.0	11
Speed up recovery	17.2	10
Compensate for eating errors	17.2	10
Gain strength	17.2	10
Increase concentration/focus	15.5	9
Decrease stress	10.3	6
Cognitive stimulation	6.9	4
Lose weight	6.9	4
Help to relax	5.2	3
Increase resistance	5.2	3
Increase emotional control	5.2	3
Gain weight	1.7	1
Doctor's prescription	1.7	1
Make me faster	1.7	1

Age: Higher age was associated with lower chances of scoring a PREDIMED total value below the median (<7), in both raw (OR=0.977; p=0.027) and adjusted models (OR=0.967; p=0.031) (Table 4).

The chances of non-compliance concerning fruit (OR=0.955; p=0.009), red and processed meats (OR=0.933; p≤0.001), wine (OR=0.936; p=0.019), legumes (OR=0.966; p=0.023) and fish or shellfish (OR=0.969; p=0.042) consumption were also lower for older individuals (Table 7, [SM3](#)).

BMI: Chances for non-compliance regarding the intake of butter, margarine, or cream were higher for individuals with higher BMI (OR=1.120; p=0.009), as well as the chances of non-compliance regarding the use of olive oil as main cooking (OR=1.183; p=0.032), and fish or shellfish consumption (OR=1.087; p=0.036) (Table 7, [SM3](#)).

Chess related-variables: The likelihood of non-compliance concerning pastries or sweets consumption was greater for individuals with longer weekly chess practice (3rd tercile) compared to those with less (1st tercile) (OR=3.127; p=0.007).

The chances of non-compliance concerning red and processed meat consumption were found for those with a higher Elo rating versus individuals who didn't report an Elo rating (OR=4.935; p=0.005). Despite not reaching statistical significance, participants with an Elo rating >1700 tended for a greater likelihood (OR=2.148; p=0.118) of non-adherence to vegetable consumption (Table 5).

Physical Activity Level: The likelihood of non-compliance concerning vegetable intake was greater for individuals with low (OR=2.837; p=0.021) and moderate (OR=2.664; p=0.012) compared with those with high physical activity level. A similar outcome was found concerning fruit consumption for those with low levels of physical activity (OR=4.580; p=0.015) (Table 7, [SM3](#)).

IGD: In the unadjusted model, the chances for a total PREDIMED score below the median were higher for those with a higher total IGD score (OR=1.067; p=0.019) (Table 4). In addition, the likelihood of non-compliance regarding fish or shellfish consumption was greater for players with higher IGD scores (OR=1.078; p=0.021) (Table 5).

Additional logistic regression results regarding predictors of non-compliance with each of the 14 PREDIMED items is provided as supplementary material ([SM3](#)).

DISCUSSION

Sociodemographics

The collected data imply that the majority of the sample is male (93.8%), and from the middle and upper classes as they were more likely to be employed, reported high levels of education, and reasonably high monthly incomes (>1455 €).

Our results suggest that higher age correlates with lower chances for a total PREDIMED score below the median and lower chances of non-compliance regarding fruit, red and processed meats, wine, legumes, and fish or shellfish consumption. This is in line with the IAN-AF 2015-16 study, which registered greater adherence to the MD in older individuals¹³.

BMI

Excessive body fat significantly raises the risk of a myriad of health complications, including cardiovascular diseases,

Table 4. Predictors of overall low adherence to the Mediterranean diet.

		PREDIMED Total < Median			
		Crude model		Adjusted model ^d	
<i>p</i> (Model)		---		0.260	
Nagelkerke's R ²		---		0.120	
	n	p	Exp(β) (95%CI)	p	Exp(β) (95%CI)
Sex		0.478		0.334	
Male	180		1 (Ref.)		1 (Ref.)
Female	12		0.639 (0.186; 2.200)		0.515 (0.134; 1.977)
Age	192	0.027*	0.977 (0.957; 0.997)	0.031*	0.967 (0.938; 0.997)
BMI	192	0.379	1.030 (0.964; 1.101)	0.055	1.078 (0.998; 1.164)
PA level		0.961		0.823	
Low	40	0.848	0.929 (0.437; 1.976)	0.937	1.036 (0.435; 2.467)
Moderate	64	0.794	0.917 (0.479; 1.757)	0.581	0.814 (0.392; 1.692)
High	88		1 (Ref.)		1 (Ref.)
Chess practice/week (h)^a		0.454		0.372	
1 st tercile	79		1 (Ref.)		1 (Ref.)
2 nd tercile	56	0.215	1.548 (0.775; 3.092)	0.223	1.586 (0.755; 3.334)
3 rd tercile	57	0.737	1.126 (0.563; 2.252)	0.911	0.957 (0.438; 2.091)
No. of competitions^b		0.625		0.475	
1 st tercile	90		1 (Ref.)		1 (Ref.)
2 nd tercile	45	0.537	0.794 (0.382; 1.652)	0.554	0.768 (0.320; 1.841)
3 rd tercile	57	0.632	1.177 (0.604; 2.292)	0.495	1.359 (0.563; 3.284)
Years of chess practice		0.575		0.658	
1 st tercile	68		1 (Ref.)		1 (Ref.)
2 nd tercile	61	0.750	0.893 (0.446; 1.789)	0.564	0.791 (0.356; 1.757)
3 rd tercile	63	0.301	0.692 (0.345; 1.389)	0.712	1.211 (0.438; 3.345)
ELO score		0.598		0.769	
NR ^c (reference)	69		1 (Ref.)		1 (Ref.)
≤1700	63	0.337	0.712 (0.355; 1.425)	0.501	0.747 (0.320; 1.747)
>1700	60	0.876	0.946 (0.472; 1.895)	0.865	0.922 (0.363; 2.345)
Registered in the FPX		0.625		0.913	
No	68		1 (Ref.)		1 (Ref.)
Yes	124		0.862 (0.475; 1.584)		0.954 (0.407; 2.233)
Total IGD score	192	0.019*	1.067 (1.011; 1.126)	0.052	1.062 (0.999; 1.129)

n: Sample size; p: Probability value; OR: Odds ratio; CI: Confidence interval; Ref.: Reference; BMI: Body mass index; FPX: Portuguese Chess Federation; IGD: Internet gaming disorder; PA: Physical activity level.

Exp(β) <1 implies a total PREDIMED score above the median; Exp(β) >1 implies a total PREDIMED score below the median.

^[a]Number of hours of chess practice per week; ^[b]Number of chess competitions in the prior 12 months; ^[c]NR: Not reported or reported "zero";

^[d]Model adjusted for all the independent variables. *p<0.05.

Table 5. Predictors of non-compliance of chess-related variables with specific PREDIMED items.

	Vegetables ≥ 2 servings/day			Red or processed meats < 1 serving/day	
<i>p</i> (Model)			---		0.011*
Nagelkerke's R2			---		0.195
	n	p	OR (95%CI)	p	OR (95%CI)
Chess practice (h/week)^a		0.295		0.414	
1 st tercile	79		1 (Ref.)		1 (Ref.)
2 nd tercile	56	0.817	1.094 (0.511; 2.343)	0.252	1.642 (0.703; 3.837)
3 rd tercile	57	0.135	1.830 (0.828; 4.042)	0.888	0.941 (0.401; 2.203)
No. of competitions^b		0.732		0.318	
1 st tercile	90		1 (Ref.)		1 (Ref.)
2 nd tercile	45	0.587	0.782 (0.322; 1.900)	0.133	0.484 (0.188; 1.247)
3 rd tercile	57	0.448	0.705 (0.286; 1.740)	0.382	0.643 (0.239; 1.731)
Years of chess practice		0.806		0.516	
1 st tercile	68		1 (Ref.)		1 (Ref.)
2 nd tercile	61	0.582	0.794 (0.349; 1.806)	0.273	0.597 (0.237; 1.502)
3 rd tercile	63	0.570	0.744 (0.268; 2.066)	0.866	0.912 (0.315; 2.640)
ELO score		0.020*		0.016*	
NR ^c (reference)	69		1 (Ref.)		1 (Ref.)
≤1700	63	0.291	0.630 (0.268; 1.485)	0.297	1.642 (0.647; 4.169)
>1700	60	0.118	2.148 (0.824; 5.600)	0.005	4.935 (1.609; 15.138)
Registered in the FPX		0.394		0.414	
No	68		1 (Ref.)		1 (Ref.)
Yes	124		1.456 (0.614; 3.453)		0.678 (0.267; 1.723)
Total IGD score	192	0.673	1.014 (0.952; 1.079)	0.936	0.997 (0.928; 1.071)

n: Sample size; p: Probability value; OR: Odds ratio; CI: Confidence interval; Ref.: Reference; BMI: Body mass index; PA: Physical activity level; FPX: Portuguese Chess Federation; IGD: Internet gaming disorder.

^[a]Number of hours of chess practice per week, ^[b]Number of chess competitions in the prior 12 months; ^[c]NR: Not reported or reported an ELO score of zero.

Note: All logistic regressions were adjusted for sex, age, BMI, and physical activity level. For each PREDIMED item, ORs <1 imply better compliance. ORs >1 imply poorer compliance.

metabolic syndrome¹⁸, mild cognitive impairment, and brain atrophy⁹, which could impair chess performance.

According to a national inquiry conducted in 2015-16, excessive adiposity characterizes more than half of the adult Portuguese population, with 36.5% being overweight, and 21.6% obese¹³. This scenario appears rather similar for our sample of Portuguese chess players as the majority classified either as overweight (35.9%) or obese (19.8%).

Chess-Related Variables

Our study detected a positive association between a higher Elo rating and non-compliance for red and processed meat

consumption and a trend for non-compliance regarding vegetable ingestion. An additional positive association between a higher number of hours of chess play per week and non-compliance concerning the consumption of pastries and sweets was found.

Fornal-Urban *et al.* (2008) reported high consumption of sweets in a sample of young (8 to 19 years) Polish elite chess players. 21.5% of respondents reported eating sweets several times per day. More than half (57.2%) declared consuming a sweet at least once per day, and a considerably greater proportion (79.2%) ingested at least one sweet per day on tournament days¹¹. Additionally, 13.3% only ate fruit and vegetables once a day and 39.5% included them in at least three meals per day¹¹.

Table 5. Continuation.

		Fish or seafood ≥ 3 servings/week		Commercial pastries/sweets ≤ 2 occasions/week	
<i>p</i> (Model)		0.001*		0.062	
Nagelkerke's R2		0.246		0.159	
	n	p	OR (95 % CI)	p	OR (95 % CI)
Chess practice (h/week)^a		0.725		0.026*	
1 st tercile	79		1 (Ref.)		1 (Ref.)
2 nd tercile	56	0.769	0.893 (0.419; 1.902)	0.107	1.929 (0.868; 4.286)
3 rd tercile	57	0.424	0.724 (0.327; 1.599)	0.007*	3.127 (1.363; 7.173)
No. of competitions^b		0.867		0.825	
1 st tercile	90		1 (Ref.)		1 (Ref.)
2 nd tercile	45	0.871	0.929 (0.381; 2.266)	0.864	1.082 (0.441; 2.654)
3 rd tercile	57	0.713	1.187 (0.475; 2.967)	0.655	0.811 (0.324; 2.030)
Years of chess practice		0.684		0.201	
1 st tercile	68		1 (Ref.)		1 (Ref.)
2 nd tercile	61	0.874	0.936 (0.415; 2.112)	0.073	2.167 (0.930; 5.050)
3 rd tercile	63	0.490	1.430 (0.517; 3.954)	0.402	1.571 (0.546; 4.526)
ELO score		0.053		0.672	
NR ^c (reference)	69		1 (Ref.)		1 (Ref.)
≤ 1700	63	0.653	1.222 (0.510; 2.930)	0.705	1.186 (0.490; 2.875)
> 1700	60	0.087	0.434 (0.167; 1.131)	0.667	0.806 (0.301; 2.155)
Registered in the FPX		0.446		0.696	
No	68		1 (Ref.)		1 (Ref.)
Yes	124		1.408 (0.584; 3.393)		0.839 (0.348; 2.024)
Total IGD score	192	0.021*	1.078 (1.011; 1.150)	0.514	1.021 (0.960; 1.086)

As becoming a highly competitive and successful chess player requires extensive chess practice (3,000 to 23,600 hours)¹⁹, the increased dedication and consequent proficiency in chess may translate into lower care or inhibitory control regarding diet quality²⁰. Indeed, our sample reported 6.3 hours of chess practice per week, and Fornal-Urban *et al.* (2008) registered notoriously greater values, with a weekly average of 11.5 hours (SD=6.4) for high-ranked youth chess players¹¹.

Additionally, given that most respondents in our sample had college degrees, the most dedicated and professional chess players may acknowledge glucose as the brain's primary energy source⁹ and be aware of its potential nootropic qualities. Thus, they might resort to sweet pastries, sugary confectionaries, and soft drinks as sources of simple sugars to enhance their performance in chess practice and competitions.

We theorize that highly cognitively demanding chess practice may increase stress and anxiety, and decrease blood glucose due to increased brain glucose consumption⁹, which may increase cravings for carbohydrate-rich foods²¹, particularly on competition days¹¹.

Mediterranean Dietary Pattern

Besides affecting health and body composition, dietary habits also influence cognition⁹. Existing literature suggests that healthy dietary patterns correlate with optimum brain performance⁹. Compared to a control diet, a meta-analysis of randomized controlled studies found significant effect sizes (ES) in favor of an MD for eight cognitive domains, including global cognition (ES=0.24, 95%CI=-0.00; 0.47), working memory (ES=0.20, 95%CI=-0.02; 0.42), and executive function (ES=0.22,

95%CI=-0.04; 0.48)²², which contribute to chess gaming performance³.

According to the IAN-AF 2015-16 study, 15.7% of Portuguese adults (18 to 64 years) have high, 50% moderate, and 34.3% low adherence to the MD¹³. Our research uncovered slightly better adhesion values. 16.7% of our sample was categorized with high adherence to the MD, 58.9% as moderate, and 24.5% of subjects had low compliance. Additionally, the IAN-AF 2015-16 survey found that 57% of Portuguese adults do not consume the minimum amount of fruit and vegetables recommended by the WHO (400 g/day)¹³. Our study revealed lower conformity to the WHO recommendations: 75% of chess players ingested less than 5 portions a day, while only a quarter (25%) ingested at least that amount.

Typically low in nutrients and rich in added sugars, the ingestion of soft drinks has been correlated to health-damaging weight gain⁹. 18.2% of our sample reported consuming one or more soft drinks per day. In comparison, the prevalence of daily consumption of ≥ 220 g of soft drinks in the IAN-AF 2015-16 inquiry was 15% for adults¹³.

According to a meta-analysis, the risk of colorectal cancer increases by 17% (95%CI=5%; 31%) for 100 g of red meat and by 18% (95%CI=10%; 28%) for 50 g of processed meat consumed daily²³. The IAN-AF 2015-16 investigation determined that 25.5% of Portuguese adults ingest more than 100 to 150 g of red meat per day¹³. In contrast, our study registered notoriously higher values (67.7%) for the daily consumption of ≥ 100 to 150 g of red or processed meat.

Dietary Supplements Consumption

A reference Portuguese population reported similar values for frequency of DS consumption, with 29.2% of adults (18 to 64 years) admitting the use of DS¹³, mainly multivitamin complexes (37.8%)¹³. Additionally, 26% reported the same main motivation for utilizing DS: "To lessen fatigue or enhance focus"²⁴.

Although the employment status differed between those who reported the intake of DS and those who did not, this result has little relevance to practice as our total sample only included nine unemployed individuals and also due to the existence of the "Other" category.

Sedentarism and Physical Activity

Our sample averaged more than six daily hours (6.4; SD=0.2) spent sitting, a slightly higher value than the 5.5 hours/day reported in the IAN-AF 2015-16 study²⁵. Sedentary activity may negatively impact overall health as it raises the risk of cardiovascular diseases, diabetes mellitus, malignancies, and

all-cause mortality⁸. In contrast, physical exercise correlates with optimal cognitive performance⁸ and it is reasonable to presume that fitness training may also help to enhance chess-related abilities including memory, cognitive processing speed, and fluid intelligence³.

The IAN-AF 2015-16 survey revealed that only 27.1% of the Portuguese adult population had a high level of physical activity, while 30.6% had a moderate, and 42.3% had a low level²⁵. In comparison, our inquiry registered a higher prevalence of high (45.8%) and moderate (33.3%) levels of physical activity in chess players, with 64.1% adhering to the WHO Physical Activity Recommendations²⁶. Moreover, low, and moderate levels of physical activity were negatively associated with fruit and vegetable consumption, respectively, compared to high physical activity levels.

Contrary to the anecdotal belief that esports contestants are inactive, top-level esports competitors of various esports titles have been documented to be physically active. A survey conducted in Portugal, which applied the IPAQ-SF to 433 players of a distinct esports title (EA SPORTS™ FIFA), reported even higher percentages for "high" levels of physical activity (84.5%) while reporting 12.9% for "moderate" and only 2.5% for "low" levels of physical activity. Additionally, the median daily sitting time was lower (5.3 hours) than ours²⁷, and relatively similar to the mean 5.5 hours/day reported in the IAN-AF 2015-16 inquiry²⁵.

IGD

IGD is associated with decreased mental health and poorer healthy habits, including sedentarism, insufficient sleep, and poor nutrition²⁸. As our sample averaged 13.5 (SD=5.4) on the IGD total score, it doesn't seem affected by gaming disorder. Although no respondent met the classification criteria for IGD, a higher score was associated with a lower total PREDIMED score and greater chances of non-compliance regarding fish or shellfish consumption, which may suggest less concern about adhering to an adequate dietary pattern due to greater dedication to the game.

Lower educational levels are linked to lower income, shorter longevity, unhealthy lifestyles, inactivity²⁹, and lower adherence to the MD³⁰. The fact that most respondents (76.6%) had at least a bachelor's degree may partially explain why our sample reported higher levels of physical activity and greater adherence to the MD than those reported by the IAN-AF 2015-16 study¹³.

Limitations

This investigation carries intrinsic limitations. Significant bias may have occurred due to users' self-selection (volunteer effect), and duplicate responses, submitting fraudulent information, or

purposefully erroneous responses. The low number of female respondents in our sample also limited comparisons between sexes.

CONCLUSIONS

Portuguese chess players are predominantly male, with higher education, belong to a medium-high socioeconomic stratum, and practice chess for 6,3 hours/day on average. They exhibit an approximate similar profile of BMI, MD adherence, DS intake, and a higher physical activity level compared to a reference population. However, they also register more daily hours spent sitting, a lower consumption of fruit and vegetables, and a higher consumption of red or processed meat. Higher IGD scores associated with a lower adhesion to the MD and fish or shellfish consumption. Greater Elo scores correlated with higher red and processed meat consumption and a trend for lower vegetable ingestion. Moreover, a higher number of hours of chess play per week related to greater consumption of pastries and sweets. The most dedicated chess players may be less concerned with maintaining a balanced diet and may require supervision from health professionals. Additional investigations are needed to clarify the influence of diet-related variables and chess playing performance.

AUTHORS' CONTRIBUTIONS

F.J.R. conceived the study, designed, and applied the survey, collected, and cleaned the descriptive statistical data, and drafted the manuscript. R.P. conceived and performed the statistical analysis and helped to draft the manuscript. All authors have read and approved the final version of the manuscript.

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The authors express that there are no conflicts of interest when writing the manuscript.

REFERENCES

- (1) Behler C. The 2020 Chess Boom - A 1,500-year-old game is now conquering the internet medium.com: medium.com; 2020 [updated 31/07/2021; cited 31/07/2021. Available from: <https://medium.com/super-jump/the-2020-chess-boom-992427704a28>.
- (2) Kersick CM, Wilborn CD, Roberts MD, Smith-Ryan A, Kleiner SM, Jager R, et al. ISSN exercise & sports nutrition review update: research & recommendations. *J Int Soc Sports Nutr.* 2018; 15(1): 38. doi: 10.1186/s12970-018-0242-y.
- (3) Burgoyne AP, Sala G, Gobet F, Macnamara BN, Campitelli G, Hambrick DZ. The relationship between cognitive ability and chess skill: A comprehensive meta-analysis. *Intell.* 2016; 59: 72-83. doi: 10.1016/j.intell.2016.08.002.
- (4) Sports Governed by International Federations Recognised by the International Olympic Committee: IOC; 2021. Available from: <https://olympics.com/ioc/recognised-international-federations>.
- (5) Franke AG, Dietz P, Ranft K, Balló H, Simon P, Lieb K. The Use of Pharmacologic Cognitive Enhancers in Competitive Chess. *Epidemiology.* 2017; 28(6): e57-e8. doi: 10.1097/ede.0000000000000737.
- (6) Franke AG, Gränsmark P, Agricola A, Schühle K, Rommel T, Sebastian A, et al. Methylphenidate, modafinil, and caffeine for cognitive enhancement in chess: A double-blind, randomised controlled trial. *Eur Neuropsychopharmacol.* 2017; 27(3): 248-60. doi: 10.1016/j.euroneuro.2017.01.006.
- (7) Kozhuharov VR, Ivanov K, Ivanova S. Dietary Supplements as Source of Unintentional Doping. *Biomed Res Int.* 2022; 2022: 8387271. doi: 10.1155/2022/8387271.
- (8) Falck RS, Davis JC, Liu-Ambrose T. What is the association between sedentary behaviour and cognitive function? A systematic review. *Br J Sports Med.* 2017; 51(10): 800-11. doi: 10.1136/bjsports-2015-095551.
- (9) Ribeiro FJ, Viana V, Borges N, Teixeira VH. The emergence of eSports nutrition: A review. *Cent Eur J Sport Sci Med.* 2021. doi: 10.18276/cej.2021.1-08.
- (10) Gupta D, Bennett-Li L, Velleman R, George S, Nadkarni A. Understanding internet gaming addiction in clinical practice. *BJPsych Advances.* 2021; 27(6): 383-93. doi: 10.1192/bja.2020.81.
- (11) Fornal-Urban A, Keska A, Dobosz J, Nowacka-Dobosz S. Nutritional habits of young chess players. *Pediatr Endocrinol Diabetes Metab.* 2008; 14(3): 187-91.
- (12) Eysenbach G. Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). *J Med Internet Res.* 2004; 6(3): e34-e. doi: 10.2196/jmir.6.3.e34.
- (13) Lopes C, Torres D, Oliveira A, Severo M, Alarcão V, Guiomar S, et al. Inquérito Alimentar Nacional e de Atividade Física, IAN-AF 2015-2016: relatório de resultados 2017. Cited 05/05/2023. Available from: https://ian-af.up.pt/sites/default/files/IAN-AF%20Relat%C3%B3rio%20Resultados_0.pdf.
- (14) Schröder H, Fitó M, Estruch R, Martínez-González MA, Corella D, Salas-Salvadó J, et al. A short screener is valid for assessing Mediterranean diet adherence among older Spanish men and women. *J Nutr.* 2011; 141(6): 1140-5. doi: 10.3945/jn.110.135566.
- (15) Martínez-González M, Corella D, Salas-Salvadó J, Ros E, Covas MI, Fiol M, et al. Cohort profile: design and methods of the PREDIMED study. *Int J Epidemiol.* 2012; 41(2): 377-85. doi: 10.1093/ije/dyq250.

- (16) Cruz S. Avaliação dos hábitos nutricionais da população portuguesa. Open Repository of the University of Porto: University of Porto; 2014.
- (17) A healthy lifestyle - WHO recommendations: World Health Organization; 2010. Cited 19/01/2024. Available from: <https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations>.
- (18) Lin X, Li H. Obesity: Epidemiology, Pathophysiology, and Therapeutics. *Front Endocrinol (Lausanne)*. 2021; 12: 706978. doi: 10.3389/fendo.2021.706978.
- (19) Gobet F, Campitelli G. The role of domain-specific practice, handedness, and starting age in chess. *Dev Psychol*. 2007; 43(1): 159-72. doi: 10.1037/0012-1649.43.1.159.
- (20) Cronin JM, McCarthy MB. Preventing game over: A study of the situated food choice influences within the videogames subculture. *J Soc Mark*. 2011; 1(2): 133-53. doi: 10.1108/20426761111141887.
- (21) Strachan MW, Ewing FM, Frier BM, Harper A, Deary IJ. Food cravings during acute hypoglycaemia in adults with Type 1 diabetes. *Physiol Behav*. 2004; 80(5): 675-82. doi: 10.1016/j.physbeh.2003.12.003.
- (22) Radd-Vagenas S, Duffy SL, Naismith SL, Brew BJ, Flood VM, Fiatarone Singh MA. Effect of the Mediterranean diet on cognition and brain morphology and function: a systematic review of randomized controlled trials. *Am J Clin Nutr*. 2018; 107(3): 389-404. doi: 10.1093/ajcn/nqx070.
- (23) Chan DS, Lau R, Aune D, Vieira R, Greenwood DC, Kampman E, Norat T. Red and processed meat and colorectal cancer incidence: meta-analysis of prospective studies. *PLoS One*. 2011; 6(6): e20456. doi: 10.1371/journal.pone.0020456.
- (24) Felício A. Consumo de suplementos alimentares em Portugal. Centro de Estudos de Gestão do Instituto Superior de Economia e Gestão Lisboa [Internet]. 2006. Cited 02/03/2023. Available from: <https://www.repository.utl.pt/handle/10400.5/15915>.
- (25) Teixeira PJ, Marques A, Lopes C, Sardinha LB, Mota JA. Prevalence and Preferences of Self-Reported Physical Activity and Nonsedentary Behaviors in Portuguese Adults. *J Phys Act Health*. 2019; 16(4): 251-8. doi: 10.1123/jpah.2018-0340.
- (26) Global recommendations on physical activity for health. <https://www.who.int/publications/i/item/9789241599979>: WHO - Guidelines Review Committee; 2010.
- (27) Pereira AM, Verhagen E, Figueiredo P, Seabra A, Martins A, Brito J. Physical Activity Levels of Adult Virtual Football Players. *Front Psychol*. 2021; 12: 596434. doi: 10.3389/fpsyg.2021.596434.
- (28) King DL, Wölfling K, Potenza MN. Taking Gaming Disorder Treatment to the Next Level. *JAMA Psychiatry*. 2020; 77(8): 869-70. doi: 10.1001/jamapsychiatry.2020.1270.
- (29) Zajacova A, Lawrence EM. The Relationship Between Education and Health: Reducing Disparities Through a Contextual Approach. *Annu Rev Public Health*. 2018; 39: 273-89. doi: 10.1146/annurev-publhealth-031816-044628.
- (30) Hu EA, Toledo E, Diez-Espino J, Estruch R, Corella D, Salas-Salvado J, et al. Lifestyles and risk factors associated with adherence to the Mediterranean diet: a baseline assessment of the PREDIMED trial. *PLoS One*. 2013; 8(4): e60166. doi: 10.1371/journal.pone.0060166.