



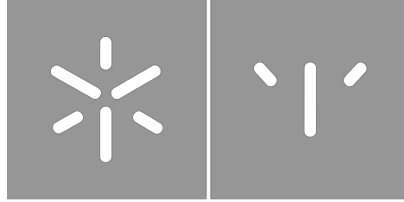
**Universidade do Minho**  
Escola de Psicologia

João **CrossFit: An Individual Work Performance Booster?**  
Fernandes

João Paulo Dias Fernandes

**CrossFit: An Individual Work Performance  
Booster?**





**Universidade do Minho**

Escola de Psicologia

João Paulo Dias Fernandes

**CrossFit: An Individual Work Performance  
Booster?**

Master's Dissertation  
Integrated Master's in Psychology

Work conducted under the orientation of  
**Doctor Ana Veloso**

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## STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

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*João Paulo Dias Fernandes*

Assinatura

## Resumo

**Objetivo:** Compreender a relação de grit com a prática de diferentes tipos de exercício físico, em especial CrossFit, e a não prática de exercício físico, assim como a sua relação com a performance individual no trabalho. **Amostra:** 427 trabalhadores, dos quais 38.6% praticavam CrossFit, 34.1% praticavam outro tipo de exercício físico e 27.3% não praticavam exercício físico. **Método:** Foram aplicados dois instrumentos, a Short Grit Scale e o Individual Work Performance Questionnaire que foram traduzidos e validados para a população portuguesa. Os resultados médios foram depois comparados entre grupos através de análises ANOVA. **Resultados:** Verificou-se uma diferença significativa de grit entre os diferentes tipos de exercício físico, com o CrossFit a mostrar os níveis de grit mais elevados, seguidos dos outros tipos de exercício físico, excluindo CrossFit, e em último os não praticantes de exercício físico. Quanto à performance individual no trabalho, encontraram-se diferenças significativas entre quase todas as subescalas da performance individual no trabalho, com os praticantes de CrossFit a mostrar os maiores níveis, seguidos dos praticantes de outros tipos de exercício físico, excluindo CrossFit, e por fim os não praticantes de exercício físico. **Conclusões:** Os resultados indicam haver um efeito significativo do exercício físico em geral nos níveis de grit assim como na performance individual no trabalho. Além disso, os praticantes de Crossfit demonstraram os maiores níveis de grit, assim como de performance individual no trabalho, comparativamente aos restantes grupos.

*Palavras-chave:* crossfit, exercício físico, grit, performance individual no trabalho

## Abstract

**Objective:** Understand the relationship between grit and the practice of different types of physical exercise, especially CrossFit, and the non-practice of physical exercise, as well as its relationship with individual work performance. **Sample:** 427 workers, of whom 38.6% practiced CrossFit, 34.1% practiced another type of physical exercise and 27.3% didn't practice any physical exercise. **Method:** Two instruments were applied, the Short Grit Scale and the Individual Work Performance Questionnaire, which were translated and validated for the Portuguese population. The mean results were then compared between groups through ANOVA analyses. **Results:** There was a significant difference in grit levels between the different types of physical exercise, with CrossFit showing the highest grit levels, followed by other types of physical exercise, excluding CrossFit, and lastly, non-exercisers. For individual work performance, significant differences were found between almost all subscales of individual performance at work, with CrossFit practitioners showing the highest levels, followed by practitioners of other types of physical exercise, excluding CrossFit, and finally non-practitioners of physical exercise. **Conclusions:** The results indicated a significant effect of both physical exercise in grit as well as individual work performance. In addition, Crossfit practitioners demonstrated the highest levels of grit, as well as individual work performance, compared to the other groups.

*Keywords:* crossfit, grit, individual work performance, physical exercise



## Index

CrossFit: An Individual Work Performance Booster? .....	7
Method .....	11
Participants .....	11
Procedure .....	13
Data Treatment .....	13
Measures .....	14
Results .....	14
Individual Work Performance Questionnaire .....	15
Short Grit Scale .....	18
Correlational Analyses .....	20
Differences Between Types of Physical Exercise .....	21
Discussion .....	22
Conclusion .....	24
Bibliography .....	25
Appendix .....	30

## Figure Index

Figure 1 .....	18
Figure 2 .....	20

## Table Index

Table 1 .....	11
Table 2 .....	15
Table 3 .....	17
Table 4 .....	18
Table 5 .....	19
Table 6 .....	20

## **CrossFit: An Individual Work Performance Booster?**

The World Health Organization (WHO, 2009, p.1) defined physical exercise as “any bodily movement produced by skeletal muscles that requires energy expenditure”. Several studies have shown the positive effects that physical exercise has on health, both physically and mentally (Alfermann & Stroll, 2000; Avilla-Palencia, 2018; Booth et al., 2012).

Alfermann and Stroll (2000) investigated the effects of physical exercise on self-concept and self-esteem in middle-aged adults. The results showed an increase in self-concept, especially physically, and self-esteem. Another study highlighted that physical exercise results in decreased body fat, decreased risks of cardiovascular and metabolic illness, increased bone health, and reduced symptoms of anxiety and depression (Booth et al., 2002). On the other hand, the lack of physical exercise is associated with a range of negative health consequences, such as an increased risk of contraction of cardiovascular diseases (heart attacks, strokes, etc...) (Tanha et al., 2011), type 2 diabetes and certain cancers (Gaetano, 2016). Booth and colleagues (2012, p. 1199) also stated that the “lack of physical activity affects almost every cell, organ, and system in the body causing sedentary dysfunction and accelerated death”. When considering all the advantages and disadvantages towards health, the importance of a physically active life becomes clear.

CrossFit is a type of physical exercise that has gained enormous popularity over the last years (Rische, 2011), having gone from 13 boxes (designation of CrossFit gyms) in 2000 to about 7000 around the world in 2019 (Armijo, 2019). Created in 2000, CrossFit is defined by Glassman (2004, p.1), one of its founders, as a "strength and conditioning system built on constantly varied, if not randomized, functional movements executed at high intensity". CrossFit aims to develop several domains, including precision, agility, balance, coordination, cardiovascular-respiratory resistance, flexibility, power, speed, endurance, and strength (Glassman, 2002, p.2). This training program's objective is to be inclusive for all types of athletes, from the person who goes for the first time to the gym to the person who has been training for many years, which is one of the main reasons for its rapid increase in popularity (Cazayoux et al., 2018). With this assumption in mind, Glassman (2007) sought to build a program that prepared its practitioners for any physical contingency in order to improve not only performance in sport, but also life in general.

Grit is a concept that's been casually associated with the CrossFit practice, even though no studies have, so far, correlated both. Sturman and Zappala-Piemme (2017, p.2) defined grit as "sustained focused effort to achieve success in a task, regardless of the challenges that present themselves, and the ability to overcome setbacks." Individuals with high levels of grit approach their

goal as a marathon. Where other people would give up, people with this characteristic remain focused (Duckworth et al., 2007). Grit is a combination of two factors, persistence of effort (PE) and consistency of interest (CE) (Duckworth et al., 2007), which “respectively, refer to the tendency to work hard even in the face of setbacks and the tendency to not frequently change goals and interests” (Credé et al., 2017, p.1). Reed and colleagues (2014) found that grit levels are higher in individuals who exercise when compared to individuals who do not practice any type of physical exercise. Similarly, using the Short Grit Scale (Grit-S), Ciaccio (2019) compared the grit levels of students with different levels of practice of physical exercise, dividing the population into three categories, inactive, insufficiently active, active, and highly active. The results described a significantly positive correlation between the level of activity of the students and the level of grit they presented, with grit levels increasing with more physical exercise. Grit has been associated with higher levels of performance at work, as well as better academic results (Duckworth et al., 2017). Duckworth and colleagues (2007) found that individuals of the same age with a higher level of grit had higher levels of education than individuals with lower levels of grit. It also found evidence that university students with a higher level of grit had better test results compared to colleagues of the same age, despite having had worse results in university entrance exams (Duckworth et al., 2007).

Ben-Ner and colleagues (2014) conducted a study to understand the effect that walking during work would have on physical activity and work performance of the participants. The study lasted for 1 year and showed significant advantages for both physical activity and work performance (both in auto and hetero evaluations). Field and colleagues (2008) reported that physical exercise at work contributed to the increase in the participants' work performance (when compared to participants who did not exercise), namely through the mood change caused by physical exercise. Finally, in another investigation, Pronk and colleagues (2004) stated that individuals with higher levels of physical activity were related to an increase in the quality of work performed and work performance in general, as well as a decrease in the total amount of effort required to perform the work and lower absenteeism.

Suzuki and colleagues (2015) sought to understand the association of grit with work performance. For this, the Japanese Grit Scale was developed, based on Duckworth's and colleagues (2007) Grit Scale, and applied to workers. Their results revealed grit to be a strong predictor of work performance. Mueller and colleagues (2017) investigated a group of entrepreneurs to explore the connection between grit and work performance, their results revealed a positive correlation between grit and venture/work performance, also, Mooradian and colleagues (2016) in another study with entrepreneurs also found that grit impacts work performance. Furthermore, Dugan and colleagues

(2019) found grit to positively correlate with work performance in a group of salespersons. With this connection between grit and work performance, it's important to explore what individual work performance (IWP) is.

IWP is a widely debated topic in the area of Industrial-Organizational (I/O) Psychology and was defined by Campbell (1990, p. 314) as "behaviours or actions that are relevant to the goals of the organization", that is, it aims to evaluate the contributions made by an individual in a given organization. It is important to note that individual performance may or may not be followed by the desired results. Kell and Motowidlo (2013) explain that the result of an individual's behaviour is often affected by external factors and these factors can enhance or hinder the actions of the individual that may be aligned or not, with the organizational objectives. He argues that this focus on the behaviour and not on the result, allows us to study more concretely the processes that lead the individual to act in a certain way. Therefore, behaviours that do not help or harm the organization do not affect its performance (Kell & Motowidlo, 2013). This concept, with a focus on the behaviours' results, differs from IWP and is called effectiveness (Campbell, 1990). Therefore, the IWP focuses only on the individual's behaviours and not on its results. Koopmans and colleagues (2011) suggested the division of the IWP into four dimensions, which although associated, are different, these being, task performance (TP), contextual performance (CP), adaptive performance (AP) and counterproductive work behaviour (CWB). However, later, Koopmans et al. (2012) concluded that AP would be only one aspect of CP, rather than a separate dimension from the rest.

That said, it is important to explore the meaning of these three concepts, task performance includes "behavioural episodes that represent task activities that are performed well and behavioural episodes that represent task activities that are performed poorly, with corresponding variability in their expected organizational value." (Kell & Motowidlo, 2013, p. 17).

Contextual performance, on the other hand, refers to "behaviour that contributes to organizational effectiveness through its effects on the psychological, social and organizational contexts of work" (Kell & Motowidlo, 2013, p.17). Several types of behaviours are part of this nuance of the IWP, such as influencing other individuals in the organization so that they are more likely to perform valuable behaviours for the organization or even act through the example, in this case, actions that show a level of dedication above the normal to the task or organization can be modelled by others and what is initially an individual influence, eventually expands into the group and possibly to the organization in general (Kell & Motowidlo, 2013). Finally, another way to influence performance through context is to perform actions that influence the organization's resources, such as "cleaning up the conference room

after a meeting, using personal resources such as the family automobile or computer for organizational business, and conserving electricity by shutting off lights when leaving an office" (Kell & Motowidlo, 2013, pp. 18-19). All these behaviours are positively reflected on the organization. On the other side of the spectrum, we find behaviours such as stealing, sabotaging or wasting organizational resources, which will harm the organization.

Finally, the counterproductive work behaviour, defined by Sackett (2012, p. 5) as "any intentional behaviour on the part of the organizational member viewed by the organization as contrary to its legitimate interests ", is divided into categories such as theft, destruction of property or misuse of time and resources, among others. It is essential to denote that this definition applies only to intentionally performed behaviours, that is, they have a specific motivation to monitor the behaviour, so unintentional counterproductive behaviours are not accounted for in this dimension. CWB also exists in TP and CP, however, as said above, for it to incorporate CWB its negative impact on the organization has to be intentional.

Grittier individuals tend to stick to objectives and work harder for longer periods of time (Duckworth et al., 2007), which has been associated with higher work performance (Suzuki et al., 2015) as well as better academics results (Duckworth et al., 2007). Also, practitioners of physical exercise show higher levels of grit than non-exercisers (Ciaccio, 2019).

Thus, the influence of grit on academic performance is quite explored, as well as the positive correlation between physical exercise and grit (Duckworth et al., 2007; Ciaccio et al., 2019; Suzuki et al., 2015; Duckworth et al., 2021; Ciaccio, 2019). However, on the organizational level, the concept isn't as well explored yet, as isn't the relationship between grit, CrossFit practice and individual work performance (IWP), specifically. Therefore, this study intends to explore the relationship between grit and physical exercise, especially CrossFit, and explore how this relation translates to IWP.

## **Hypothesis**

This study intends to answer the following questions: 1) Are there differences in the levels of grit between CrossFit practitioners, non-practitioners of physical exercise and practitioners of other types of physical exercise, excluding CrossFit? 2) Are there differences in TP, CP and CWB between CrossFit practitioners, non-practitioners of physical exercise and practitioners of other types of physical exercise, excluding CrossFit? 3) Does physical exercise, especially CrossFit, improve IWP?

Having said that, the following hypotheses are proposed:

Hypothesis 1: CrossFit practitioners will have higher levels of grit, compared to non-practitioners of physical exercise and practitioners of other types of physical exercise, excluding CrossFit;

Hypothesis 2: Practitioners of other types of physical exercise, excluding CrossFit, will present higher levels of grit, compared to non-exercisers;

Hypothesis 3: CrossFit practitioners will present higher Task Performance, Contextual Performance and lower Counterproductive Work Behaviour compared to non-exercisers and practitioners of other types of physical exercise, excluding CrossFit;

Hypothesis 4: Practitioners of other types of physical exercise, excluding CrossFit, will present higher Task Performance, Contextual Performance and lower Counterproductive Work Behaviour compared to non-exercisers.

## Method

### Participants

This study sample is composed of 461 participants, of which 23 were excluded from the data analysis for not accepting the informed consent (N = 5) and 18 others weren't workers, leaving 461 participants. Of our sample, 427 were Portuguese (92.6%), 25 were Brazilian (5.4%) and 9 were of another nationality (2.0%). Two thousand and sixty-eight participants were male (58.1%), 191 were female (41.4%) and 2 identified with another gender (0.4%). For professional situation, our sample was comprised of 425 full-time workers (92.2%) and 36 part-time workers (7.8%). Furthermore, 187 participants completed a bachelor's degree (40.6%), 156 completed a master's degree (33.8%), 95 completed high school (20.6), 12 completed a PhD/post-doctoral (2.6%), 8 completed less than high school (1.7%) and 3 completed a post-graduation (0.7%). Finally, regarding the type of physical activity, 178 participants were CrossFit practitioners (38.6%), 157 were physical exercise practitioners of some kind, excluding CrossFit (34.1%) and 126 didn't practice any kind of physical exercise (27.3%).

**Table 1**

*Sociodemographic Description of the Sample*

Sociodemographic Variables	N	%
Nationality		
Portuguese	427	92.6
Brazilian	25	5.4
Other	9	2.0
Gender		
Male	268	58.1
Female	191	41.4

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Other	2	0.4
Professional situation		
Full-Time	425	92.2
Part-Time	36	7.8
Education Level		
Bachelor's degree	187	40.6
Master's Degree	156	33.8
High school	95	20.6
PhD/Post-doctoral	12	2.6
Less than High School	8	1.7
Post-Graduation	3	.7
Civil State		
Single	272	59.0
Married	98	21.3
Union of Fact	75	16.3
Divorced	14	3.0
Other	2	.4
Type of Profession		
Intellectual and scientific activities specialists	192	41.6
Intermediate technicians and professions	108	23.4
Administrative staff	51	11.1
Private services, protection, security, and sales workers	35	7.6
Qualified industry, construction, and craftsmen workers	27	5.9
Non-Qualified workers	20	4.3
Legislature and bodies representatives	13	2.8
Armed forces professions	6	1.3
Installation, machinery, and assembly workers/operators	6	1.3
Farmers and qualified farmers, fishermen and forest workers	3	.7
Physical Exercise		
CrossFit	178	38.6
Other	157	34.1
Nothing	126	27.3

---

## **Procedure**

Initially, as the Grit-S and the Individual Work Performance Questionnaire (IWPQ) did not have a validated translation for the Portuguese population, we had to translate them from English to Portuguese. To this end, we made four translations with different researchers, compared them and then did the reverse translation and compared it to the original scales.

Then, the questionnaire was created using Google Forms. After being approved by the Ethics Committee of the University of Minho (CEICSH 127/2021), the questionnaire's link was shared via various social networks (WhatsApp, Instagram, Facebook, and Reddit). Participants didn't receive any reward for completing the questionnaire.

The initial part of the questionnaire was composed of an informed consent, in which participants could choose whether to participate in the study or not. After that, they would have to fill out a socio-demographic questionnaire that collected information about their age, gender, nationality, academic degree, marital status and whether the participant was a worker. If the participant worked, he could continue the study. Otherwise, he would be taken to the end of the form and his participation would end there.

Then, we asked about their practice of physical exercise: if practised, the participant was asked what type of physical exercise, how many times and how many hours a week and if he practised some other type of physical exercise. In the case of more than one type, the previous questions were repeated up to a total of three types of physical exercise. On the other hand, if he did not practice any type of physical exercise, he would go directly to fill the Grit-S and IWPQ.

First, the Grit scale was presented, followed by questions about the type of profession of the participants and what their work regime was. Finally, the participant completed the IWPQ, followed by the submission of the form and finalization of the questionnaire.

After sharing the questionnaire, I went to the data analysis phase, using the Statistical Package for the Social Science (SPSS) program, version 26.

## **Data Treatment**

After the questionnaire's distribution, the data were exported to an Excel spreadsheet and imported to SPSS where various analyses were done: 1) Descriptive analysis of the sample; 2) Cronbach's Alpha coefficient calculation of both instruments and respective subscales; 3) Factorial Analysis of both instruments; 4) Pearson's correlations to evaluate the associations between types of exercise, grit and IWP; 5) Univariate analysis of variance (ANOVA) to examine if there were differences in levels of grit and IWP between CrossFit practitioners, no physical exercise practitioners and physical



exercise practitioners, excluding CrossFit. A 95% level of confidence was used for all tests.

## **Measures**

### **Sociodemographic Questionnaire**

To gather sociodemographic information about the participants, a sociodemographic questionnaire was made. Our questionnaire inquired about the participants' age, gender, nationality, academic degree, civil status and if the participants worked or not.

### **Individual Work Performance Questionnaire (IWPQ; Koopmans et al., 2012)**

To evaluate Individual Work Performance (IWP) a translated and validated version for the Portuguese population of the Individual Work Performance Questionnaire (IWPQ) ( $\alpha = 0.758$ ). This instrument assesses 3 dimensions: Task performance ( $\alpha = 0.791$ ), contextual performance ( $\alpha = 0.883$ ) and counterproductive work behaviour ( $\alpha = 0.756$ ) (Koopmans et al., 2012), consisting of a total of 18 items and presented an overall. All items were based on a recall period for the 3 months before the questionnaire and a Likert scale of 5 points (1 = "never" to 5 = "always") was applied.

### **Short Grit Scale (Grit-S; Duckworth & Quinn, 2009)**

To evaluate the grit level of the participants a translated and validated version of the Short Grit Scale for the Portuguese population (Grit-S) ( $\alpha = 0.780$ ) was used. This scale consists of 8 questions and evaluates two dimensions, the consistency of interest (CE) ( $\alpha = 0.780$ ) and the persistence of effort (PE) ( $\alpha = 0.660$ ) (Duckworth et al., 2007), using a 5-point Likert scale going from 0 = "Nothing like me" to 5 = "Exactly like me".

## **Results**

### **Scales Validation**

For the validation of an instrument, it's necessary to make the psychometric characterization of them, testing its fidelity and validity. The fidelity of an instrument is related to the suitability or usefulness of an existing instrument, or in this case, the suitability or usefulness of translating the same instrument into another language (Kathleen et al., 2006).

On the other hand, it is also important to explore whether the instrument used measures match what it proposes to measure (Blumberg, 2005). So, the validity of an instrument evaluates the degree to which the instrument measures what it was made to measure (Robson, 2011), being directly related to if the results of that same instrument are true or, in other words, valid.

For the fidelity, the Cronbach's Alpha of each scale and subscale for both instruments, IWPQ and Grit-S, was calculated. The Cronbach's Alpha, developed by Lee Cronbach is a measure that calculates the internal consistency of an instrument or subscale. Its result ranges between 0-1, with

values closer to 1 indicating that the items of the scale or subscale measure the same construct (Tavakol, 2011). Cronbach's Alpha values higher than 0.800 indicate good internal consistency, while values higher than 0.600 are acceptable in scales with a low number of items (Hill, 2008).








To ascertain the instruments' validity, a factorial analysis was done using the maximum likelihood method, followed by a Direct Oblimin oblique rotation.
















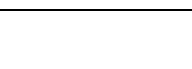
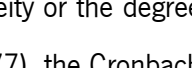
### **Individual Work Performance Questionnaire (IWPQ; Koopmans et al., 2012)**

General data information, skewness (SK), kurtosis (Ku) and a histogram for each item of the IWPQ scale is presented in table 2. This information was used to assess the distributional properties, as well as the psychometric sensitivity of the data. The SK and Ku are important data because they give us a hint regarding the distribution of the data, SK measures the asymmetry of a given distribution around its mean (Čisar, 2010). If the distribution of data is perfectly symmetric then SK will be close to 0. However, if it's positive or negative it will have an asymmetric distribution with the tail extending to its positive or negative side, respectively. "Kurtosis characterizes the relative peakedness or flatness of a distribution compared with the normal distribution" (Čisar, 2010, p.96). When Ku values are close to 0 it indicates that the data has a perfect normal distribution, while a positive value indicates a peaked distribution and a negative value a flat distribution (Čisar, 2010). However, in studies it isn't expected for the normal distribution to be perfect, so values of Ku and SK between -1 and 1 were considered acceptable to consider a normal distribution (Martins, 2011).

**Table 2**

#### *IWPQ Descriptive Statistics*

IWPQ items	N	Min	Ma x	Mea n	SD	Skewness		Kurtosis		Histogram
						Statistics	Error	Statistics	Error	
<b>IWPQ-1</b>	461	1	4	2,96	,718	-,720	,114	,959	,227	
<b>IWPQ-2</b>	461	0	4	2,70	,706	-,616	,114	,591	,227	
<b>IWPQ-3</b>	461	0	4	3,04	,723	-,715	,114	1,088	,227	
<b>IWPQ-4</b>	461	1	4	2,87	,737	-,508	,114	,315	,227	
<b>IWPQ-5</b>	461	1	4	2,92	,641	-,525	,114	1,007	,227	
<b>IWPQ-6</b>	461	0	4	2,55	,819	-,425	,114	-,068	,227	
<b>IWPQ-8</b>	461	0	4	2,63	,918	-,547	,114	,171	,227	

<b>IWPQ-9</b>	461	0	4	3,08	,776	-,780	,114	,899	,227	
<b>IWPQ-10</b>	461	0	4	2,84	,840	-,569	,114	,234	,227	
<b>IWPQ-11</b>	461	1	4	3,02	,780	-,472	,114	-,172	,227	
<b>IWPQ-12</b>	461	1	4	3,05	,773	-,536	,114	-,024	,227	
<b>IWPQ-13</b>	461	0	4	2,70	,810	-,282	,114	,027	,227	
<b>IWPQ-14</b>	461	0	4	2,53	,929	-,339	,114	-,172	,227	
<b>IWPQ-15</b>	461	0	4	2,71	,848	-,443	,114	,297	,227	
<b>IWPQ-16</b>	461	0	4	2,72	1,11 1	-,746	,114	-,073	,227	
<b>IWPQ-17</b>	461	0	4	2,85	,813	-,431	,114	-,076	,227	
<b>IWPQ-18</b>	461	0	4	2,81	,930	-,568	,114	,042	,227	
<b>IWPQ-19</b>	461	0	4	2,74	,706	-,398	,114	,392	,227	
<b>IWPQ-20</b>	461	0	4	1,53	,981	,389	,114	-,199	,227	
<b>IWPQ-21</b>	461	0	4	1,13	,872	,783	,114	,594	,227	
<b>IWPQ-22</b>	461	0	4	1,41	,913	,378	,114	-,147	,227	
<b>IWPQ-23</b>	461	0	4	1,91	1,01 0	-,092	,114	-,476	,227	
<b>IWPQ-24</b>	461	0	4	1,80	1,03 8	-,015	,114	-,643	,227	
<b>IWPQ-25</b>	461	0	4	,85	,712	,871	,114	1,785	,227	

For assessing internal consistency, which “estimates relate to item homogeneity or the degree to which the items on a test jointly measure the same construct” (Henson, 2001, p.177), the Cronbach Alpha was computed, and all values were considered acceptable, being higher than 0.6. Even when analysing other 2 IWPQ validations (Dåderman et al., 2019; Koopmans et al., 2016) along with the original scale (Koopmans et al., 2012) in table 3, we can see similar results regarding internal consistency across all subscales.

**Table 3***Cronbach's alpha values of the Dutch, American-English, Swedish and Portuguese Versions of the IWPQ*

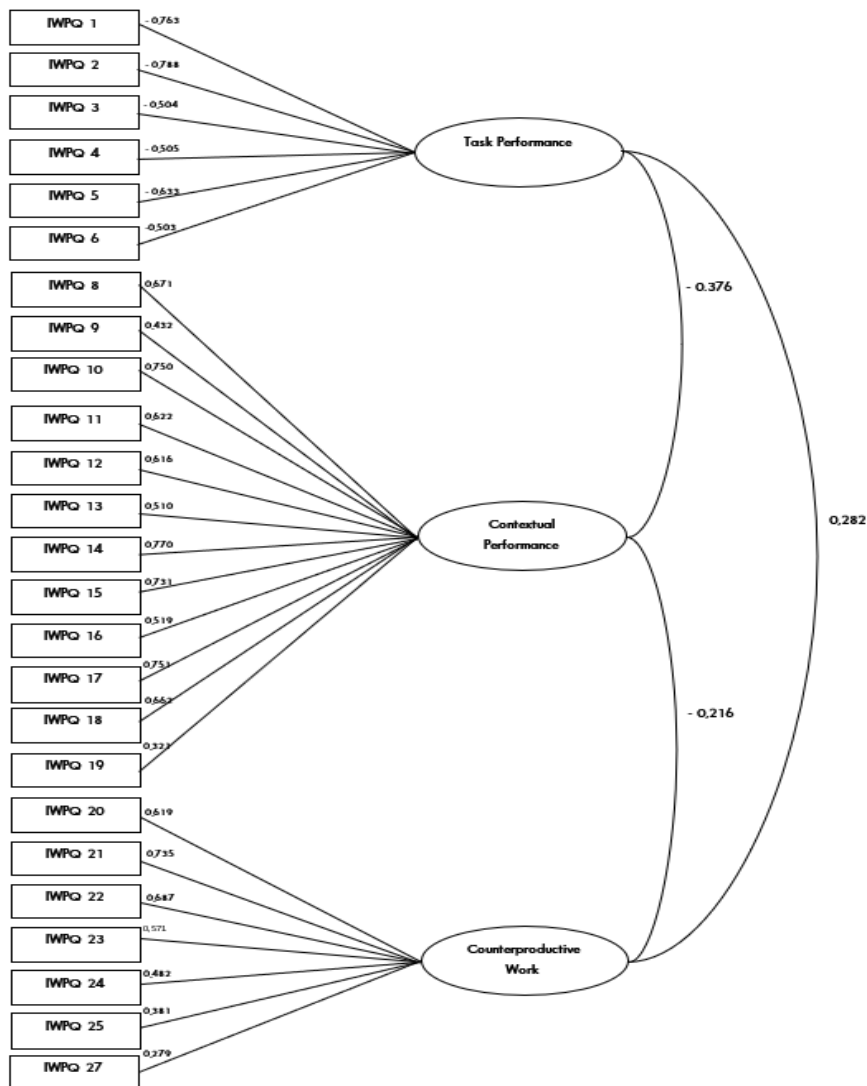
<b>IWPQ</b>	<b>Population</b>	<b>N</b>	<b>TP</b>	<b>CP</b>	<b>CWB</b>
<b>Portuguese</b>	Adult Workers between 18-66 years old	461	.79	.88	.76
<b>Swedish</b>	Adults in Managerial Positions	206	.74	.82	.73
<b>American- English</b>	Adult Workers	40	.79	.83	.89
<b>Dutch (Original)</b>	Adult Workers	1424	.78	.85	.79

To assess validity, a Factorial Analysis (FA) was made, to ascertain the possible factor correlations, all common factors extracted showed an eigenvalue higher than 1 (Marôco, 2007). The Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity (BTS) were also tested. The KMO test = 0,856, indicated optimum sample adequacy and the BTS showed significant statistical difference ( $p < 0,05$ ), suggesting that the scales variables had some type of association.

When analysing the FA, figure 1, almost all items showed a factor loading superior to 0.3, however, items seven "Collaboration with others was very productive" and twenty-six "I managed to get off from a work task easily" showed unexpected factor loading values. Item seven showed a higher factor loading with the CP subscale (0.292) than with the TP scale (-0.107) which is the scale it was contained in the original study (Koopmans, 2014) and item twenty-seven showed a 0.032 factor loading value regarding the expected factor it should fit (CWB subscale). So those two items were cut from this studies results.

**Figure 1**

*IWPQ tri-factor structure fit*



*Note.* Correlations between latent variables and factor loading for each item are shown

**Short Grit Scale (Grit-S; Duckworth & Quinn, 2009)**

As with the IWPQ scale, general descriptive information about the data is presented in table 4. Also, values of SK and Ku between -1 and 1 were acceptable as indicators of normal distribution,

**Table 4**

*Grit-S Descriptive Analysis*

GRIT-S items	N	Min	Max	Mean	Standard Deviation	Skewness		Kurtosis		Histogram
						Statistics	Error	Statistics	Error	
GRIT-S 1	461	0	4	1,97	1,036	-,019	,114	-,566	,227	

<b>GRIT-S 2</b>	461	0	4	2,11	1,071	,118	,114	-,810	,227	
<b>GRIT-S 3</b>	461	0	4	2,24	1,105	-,303	,114	-,749	,227	
<b>GRIT-S 4</b>	461	0	4	2,93	,838	-,652	,114	,381	,227	
<b>GRIT-S 5</b>	461	0	4	2,36	,977	-,389	,114	-,463	,227	
<b>GRIT-S 6</b>	461	0	4	2,36	1,150	-,487	,114	-,605	,227	
<b>GRIT-S 7</b>	461	0	4	2,54	,928	-,499	,114	-,190	,227	
<b>GRIT-S 8</b>	461	0	4	2,97	,864	-,753	,114	,688	,227	

For internal consistency, our study showed adequate results. Even when comparing this study Cronbach's alpha values to the original scale's values as shown in table 5 (Duckworth et al., 2009), we can denote they are very similar, with some values for this study being higher than most of the originals (Consistency of Interest and Perseverance of Effort). Overall, with all values being bigger than 0.60, an adequate internal consistency can be claimed.

**Table 5**

*Cronbach's alpha values of the Original English and Portuguese Versions of the Grit-S Scale*

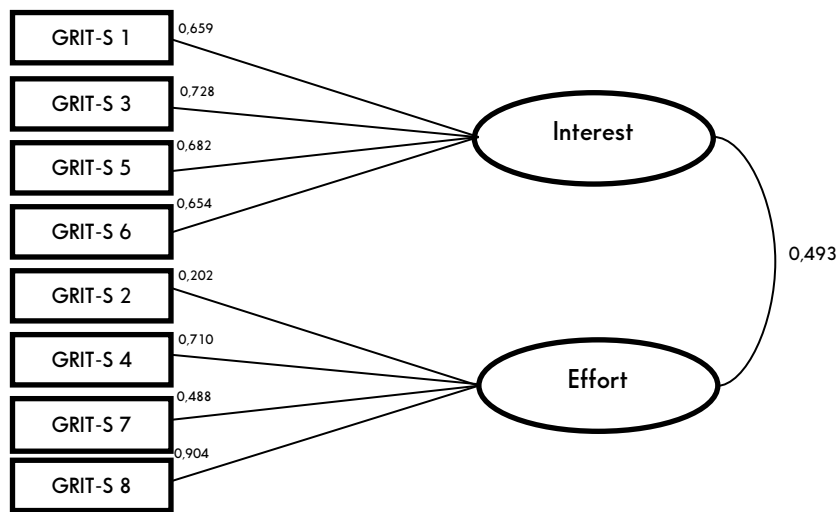
<b>Grit-S Version</b>	<b>Population</b>	<b>N</b>	<b>Grit-S</b>	<b>Consistency of Interest</b>	<b>Perseverance of Effort</b>
<b>Portuguese</b>	Adults between 18-66 years old	461	0.78	0.78	0.66
<b>Original</b>	West Point 2008	1218	0.73	0.73	0.60
	West Point 2010	1308	0.76	0.74	0.65
	2005 National Spelling Bee	175	0.80	0.76	0.65
	Ivy League Undergraduates	139	0.83	0.79	0.78

Both the Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity (BTS) were tested. The KMO test = 0,819, indicating optimum sample adequacy and the BTS showed significant statistical difference ( $p < 0,05$ ), suggesting that the scales variables have some type of association. These findings match the model used by Duckworth and colleagues (2009) when validating the Grit-S.

In figure 2 we can see the loading factors for all items, with almost all showing a factor loading superior to 0.3, minus Item 2 (.202) which matches the original scale's results.

**Figure 2**

*Grit-S Factor Structure Fit*



*Note.* Correlations between latent variables and factor loading for each item are shown

Overall, both translated instruments showed acceptable validation results, and as such were deemed acceptable to use with the Portuguese population.

### **Correlational analyses**

We examined correlations between grit, TP, CP, and CWB. Results are shown in Table 5. The results show that grit was positively correlated with TP ( $r = .445, p < .001$ ) and with CP ( $r = .490, p < .001$ ), indicating that individuals with higher levels of grit tend to have higher scores on both TP and CP. On the other hand, grit was negatively correlated with CWB ( $r = -.364, p < .001$ ), suggesting individuals with higher levels of grit tend to score lower on CWB.

TP was positively correlated with CP ( $r = .428, p < .001$ ), indicating that individuals with higher scores on TP tend to report higher scores on CP as well. However, TP showed a negative correlation with CWB ( $r = -.253, p < .001$ ), suggesting that individuals with higher scores on TP report lower scores on CWB.

Additionally, CP was negatively correlated with CWB ( $r = -.192, p < .001$ ), showing that individuals who score higher on CP tend to score lower on CWB.

**Table 6**

*Correlational analyses between Grit, TP, CP, and CWB.*

Variables	1	2	3	4
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1. GRIT	-	.445*	.490*	-.364*
2. TP**		-	.428*	-.253*
3. CP***			-	-.192*
4. CWB****				-

\* p < .01, \*\* task performance, \*\*\* Contextual Performance, \*\*\*\* Counterproductive Work Behaviour

### Differences between types of physical exercise

Univariate analyses of variance (ANOVAs) were performed to examine possible differences in grit, task performance, contextual performance, and counter-productive work behaviour. Results showed a significant effect of grit,  $F(2,458) = 53.528$ ,  $p < .001$ . Post-hoc Bonferroni tests indicated that individuals that practice CrossFit reported higher grit ( $M = 2.76$ ;  $SD = .50$ ) than individuals that practice other type of physical exercise ( $M = 2.34$ ;  $SD = .58$ ),  $p < .001$ , and compared with individuals that didn't practice any type of physical exercise ( $M = 2.10$ ;  $SD = .64$ ),  $p < .001$ . In addition, individuals that practice other type of physical exercise reported higher grit ( $M = 2.34$ ;  $SD = .58$ ) than individuals that didn't practice any type of physical exercise ( $M = 2.10$ ;  $SD = .64$ ),  $p = .002$ . Furthermore, results also showed a significant effect of task performance,  $F(2,458) = 10.714$ ,  $p < .001$ . Post-hoc Bonferroni tests indicated that individuals that didn't practice any type of physical exercise reported lower task performance scores ( $M = 2.68$ ;  $SD = .53$ ) than individuals that practice CrossFit ( $M = 2.91$ ;  $SD = .40$ ),  $p < .001$  and also with individuals that practice other type of physical exercise ( $M = 2.90$ ;  $SD = .46$ ),  $p < .001$ . Moreover, results also showed a significant effect of contextual performance,  $F(2,458) = 15.000$ ,  $p < .001$ . Post-hoc Bonferroni tests indicated that individuals that practice CrossFit reported higher contextual performance scores ( $M = 2.96$ ;  $SD = .47$ ), than individuals that practice other type of physical exercise ( $M = 2.79$ ;  $SD = .56$ ),  $p = .017$ , and comparing with individuals that didn't practice any type of physical exercise ( $M = 2.61$ ;  $SD = .64$ ),  $p < .001$ . In addition, individuals that practice other type of physical exercise reported higher contextual performance scores ( $M = 2.79$ ;  $SD = .56$ ) than individuals that didn't practice any type of physical exercise ( $M = 2.61$ ;  $SD = .64$ ),  $p = .018$ . Additionally, results also showed a significant effect of counter-productive work behaviour,  $F(2,458) = 6.913$ ,  $p = .001$ . Post-hoc Bonferroni tests indicated that individuals that practice CrossFit reported lower counter-productive work behaviour scores ( $M = 1.50$ ;  $SD = .47$ ) than individuals that practice other type of physical exercise ( $M = 1.64$ ;  $SD = .51$ ),  $p = .037$ , and also with individuals that didn't practice any type of physical exercise ( $M = 1.71$ ;  $SD = .54$ ),  $p = .001$ .



## Discussion

Hypotheses 1 and 2 were confirmed by our data analysis, where CrossFit participants ( $M = 2.76$ ) scored higher on grit than both non-physical exercise practitioners ( $M = 2.10$ ) and other types of physical exercise practitioners ( $M = 2.34$ ), while other types of physical exercise practitioners (OTPEP) had higher grit than non-exercisers. These results support the existing literature in which it was expected that physical exercise practitioners showed higher levels of grit than non-exercisers, as shown by Reed and colleagues (2014) and Ciaccio (2019). Also, Cormier and colleagues (2021), investigated the effect of grit in athletes, specifically its effect on different types of competitive athletes and they found that higher competitive levels translated into higher grit levels. Cazayoux and DeBeliso (2019) examined grit levels between different types of CrossFit athletes (advanced and novice) and found that advanced athletes display higher levels of grit than novice athletes. CrossFit is a type of high-intensity interval training, defined by Glassman (2007, p. 1) as a “strength and conditioning system built on constantly varied, if not randomized, functional movements executed at high intensity” that distinguishes itself by its elevated intensity when compared to other types of physical exercises. The physical exercise practitioners’ group, excluding CrossFit, included several different types of exercise such as different teams’ sports, running, bodybuilding and martial arts. Drum and colleagues (2017) compared the perceived demands and postexercise physical disfunction in Crossfit practitioners and on American College of Sports Medicine (ACSM) based resistance training sessions, participants reported significantly higher perceived demands for CrossFit training as well as higher post-exercise physical dysfunctions, such as muscle soreness and muscle pain to touch. Also, Brisebois and colleagues (2016) compared a CrossFit training session with an ACSM session and found that CrossFit generated higher heart rate peaks and  $VO_2$  peaks, which suggests CrossFit results in greater energy expenditure compared to traditional exercise. The literature suggests that CrossFit does present a higher intensity type of training than other types of physical exercise and grit levels have been shown to increase along with the intensity of physical exercise an individual practices (Reed et al., 2014). So, it was expected for CrossFit participants to show higher grit when compared to other types of physical exercise, as was also demonstrated by our results.

Regarding hypothesis 3, CrossFit demonstrated significantly higher TP than non-exercise practitioners. However, there was no significant difference between physical exercise practitioners, which goes against our hypothesis. It’s interesting to mention that, when analysing the mean results, CrossFit did show a higher mean ( $M = 2.91$ ) than OTPEP ( $M = 2.90$ ). For CP, the results showed significant differences between all groups with CrossFit showing the highest CP ( $M = 2.95$ ), followed by

other types of physical exercisers ( $M = 2.79$ ) and at last, non-exercise practitioners ( $M = 2.60$ ). Finally, CrossFit showed significant lower counterproductive work behaviour than the other 2 groups ( $M = 1.50$ ). Grit is “perseverance and passion for long-term goals” (Duckworth et al., 2007, p. 1087) which means that individuals with higher levels of grit are likely to try more and maintain the same passions longer when working towards their specific goals. Duckworth and colleagues (2021) analysed how grit can influence work performance and found three aspects in which grit influences it. Firstly, through retention, in which is expected that grittier individuals persevere longer on their jobs and increase work performance through increased work experience (Duckworth et al., 2021). Secondly, it can increase work performance via work engagement (Suzuki et al., 2015). Thirdly, some studies (Mueller et al., 2017; Mooradian et al., 2016) have shown the direct influence of grit on work performance. However, it’s also important to underline the possible negative effects that grit can have on work performance, because extreme perseverance on tasks may also have a negative effect when the task itself is no longer positive for the organization or negatively impact retention when gritty individuals’ values don’t match the organization values, which leads to turnover (Duckworth et al., 2021). The current literature suggests that grittier individuals will have better work performance, which matches this study’s hypothesis where CrossFit individuals, that presented higher grit levels than the remaining groups, also showed better work performance results in almost all IWP subscales.

At last, hypothesis 4 was also only partially confirmed with OTPEP, also showing higher TP ( $M = 2.90$ ) and CP ( $M = 2.79$ ) than non-exercisers ( $M = 2.68$  and  $M = 2.60$ ). However, OTPEP ( $M = 1.64$ ) didn’t show significant differences regarding CWB when compared to non-exercisers ( $M = 1.71$ ). Dunston and colleagues (2020) studied the association between grit and physical activity in college students, their results showed that individuals that engaged in more physical exercise were more likely to have higher grit scores. Also, in another investigation with university students, students presented a positive correlation of grit with both domestic physical activity and leisure-time physical activity. When analysing the literature we can see the benefits physical exercise display on grit, suggesting that individuals who exercise are likely to have higher levels of grit and, as stated above, grit seems to increase work performance, as was also reported in our investigation.

## **Conclusion**

The present study’s goal was to comprehend how different types of physical exercise relate to grit levels, especially CrossFit, and how it would relate to individual work performance. The effect of grit on work performance is a concept that isn’t well explored in the literature, as well as no study has been

done comparing grit levels amongst different types of physical exercise and how it could relate to individual work performance. We hope our study contributes by bringing more information about the relation between grit and individual work performance but also by bringing up a possible new theme that is grit levels between different types of physical exercise and how that could affect IWP.

Our results suggest that CrossFit does influence grit levels and individual work performance, with CrossFit reporting higher grit levels and well as higher IWP. Nevertheless, our investigation showed the importance that any kind of physical exercise has on both IWP and grit, when compared with non-exercisers. It's also important to underline the effect grit has on IWP. When correlating grit with the IWP subscales, we could see a significant effect of grit on IWP, with higher levels of grit corresponding to higher TP and CP and, inversely, lower CWB. Our correlations showed that higher levels of grit translate into higher levels of IWP.

This opens the door for workplaces to consider physical exercise implementation as a way of improving their collaborator's IWP, which as been shown to have multiple benefits (Duckworth et al., 2021).

This study dived into an unexplored topic in the literature when investigating how physical exercise, especially CrossFit, would affect both grit levels and IWP, opening the door to future studies.

However, it's important to understand our study's limitations. First, our study was made with the Portuguese population with a sample of 461 participants which could not translate to the Portuguese population. Also, the OTPEP group was comprised of a lot of different types of physical exercise. So, when compared to the other two groups, different variables could influence the results. Finally, for the CWB subscale, a translation mistake was made where the 5-point Likert scale went from "never" to "always" when it should have been from "never" to "often".

Finally, it would be interesting for future studies to explore the effect that different types of physical exercise have on both grit levels and IWP, as that could have had an important role in our findings.

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## Appendix

### Ethics Subcommittee Approval



Universidade do Minho  
Conselho de Ética

#### **Comissão de Ética para a Investigação em Ciências Sociais e Humanas**

Identificação do documento: CEICSH 127/2021

Relatores: Emanuel Pedro Viana Barbas Albuquerque e Marlene Alexandra Veloso Matos

Título do projeto: *CrossFit: Potenciador da Performance Individual no Trabalho?*

Investigadora Responsável: João Paulo Dias Fernandes (IR), Mestrado Integrado em Psicologia, Escola de Psicologia, Universidade do Minho; Professora Doutora Ana Luísa Oliveira Marques Veloso (Orientadora), Escola de Psicologia, Universidade do Minho

#### **PARECER**

A Comissão de Ética para a Investigação em Ciências Sociais e Humanas (CEICSH) analisou o processo relativo ao projeto de investigação acima identificado, intitulado *CrossFit: Potenciador da Performance Individual no Trabalho?*.

Os documentos apresentados revelam que o projeto obedece aos requisitos exigidos para as boas práticas na investigação com humanos, em conformidade com as normas nacionais e internacionais que regulam a investigação em Ciências Sociais e Humanas.

Face ao exposto, a Comissão de Ética para a Investigação em Ciências Sociais e Humanas (CEICSH) nada tem a opor à realização do projeto nos termos apresentados no Formulário de Identificação e Caracterização do Projeto, que se anexa, emitindo o seu parecer favorável, que foi aprovado por unanimidade pelos seus membros.

Braga, 20 de janeiro de 2022.

O Presidente da CEICSH

(Acílio Estanqueiro Rocha)

**Anexo:** Formulário de identificação e caracterização do projeto