



Impulsivity among young adults: Differences between and within Western and Arabian populations in the BIS-11

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Abstract

Impulsivity (or impulsiveness) is a psychological trait with a long history in research and a large amount of accepted associations with other traits and with life outcomes. But it is rarely studied outside of the Western world, raising questions as to whether it can be generalized beyond this. In this study the Barratt Impulsiveness Scale 11 (BIS-11) was administered on two university student samples; one Egyptian ($N=450$) and one Saudi ($N=396$), in order to close this gap and to observe differences between sexes and cultures. We compared the Saudi samples with samples from typical Western countries (Germany, USA) by using Hofstede's cultural dimensions as a means of assessing cultural differences. We found no indicators of sex differences or cultural differences along the superficial division between countries from the Western and Arab-Muslim world. Also, more differentiated cultural dimensions were predominantly unrelated to BIS-11 factor scores. Implications for further research and limitations, such as the inclusion of more samples from Arab-Muslim countries and the use of samples more representative for the whole population, were discussed.

Keywords Impulsivity · Cross-cultural · Sexual differences · Egypt · Saudi Arabia · University students

Introduction

Impulsiveness

The psychological construct of impulsiveness has been a focus of research for a long time. An early definition by Murray

(1938, p.148, 200, 205) described it as a lack of cognitive reflection before the transformation of inner intuitions into external acting or the inability of inhibitory control over one's own behavior. An impulsive personality is thus seen as a counterpart to a personality of deliberation and tends to involve quick, emotional and thoughtless reactions to effects

Highlights

- Measurements of impulsivity in less observed countries (Egypt and Saudi Arabia)
- Observation of differences in impulsivity between sexes and across cultures
- Significantly higher average of impulsivity in Saudi Arabia compared to Egypt
- Significantly higher average of impulsivity of males compared to females in the Saudi Arabic sample
- No clear evidence of higher or lower impulsivity in Arabic samples compared to Western samples

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from the social environment. Impulsivity is associated with failing to planning ahead. This definition is largely consistent with that constructed by Grayson and Tolman (1950), which, however, added the positive aspect of spontaneity. Eysenck and Eysenck (1963) describe impulsiveness as an essential part of the Big Five personality dimension Extraversion. Later, they found that the broader concept of impulsiveness can be divided into the four sub-factors: (1) acting from an impulse without prior reflection, (2) risk taking, (3) non-planning and (4) liveliness (Eysenck and Eysenck 1977).

In 2001, Whiteside and Lynam developed the UPPS Impulsivity Scale based on the four subscales: Urgency (impulsiveness due to negative effects), lack of premeditation (similar to non-planning and a lack of cognitive reflection), lack of perseverance (inability to concentrate on difficult tasks), and sensation seeking (similar to spontaneity and liveliness). More recent sources defined impulsiveness as a “construct relevant to explaining both normal individual differences in personality and more extreme personality pathology among clinical populations” (Stanford et al. 2009) and as the decisive factor leading from high anger to physical violence and reactive and proactive aggression (Ammerman et al. 2015; Hecht and Latzman 2015). It becomes clear that, despite the great variety of concepts, there are many key similarities, especially with regard to the tendency of individuals to not plan ahead or to not reflect before the transformation of an inner impulse into real acting.

The wide spread of impulsiveness as a dimension in personality psychology has led to a large number of correlates being found. Eysenck et al. (1985) reported positive and mostly significant correlations of impulsiveness, measured with the I₆ Impulsiveness Questionnaire on a normative sample, of .46 to .45 (males vs females) with psychotism, of .39 to .22 with extraversion, .24 to .11 (non-significant) with venturesomeness and .20 to .22 with neuroticism. The same source reported a significant negative correlation to a score for lying of −.38 to −.18. Scores on the UPPS Impulsivity Scale were weakly associated with pathological gambling but very strongly with borderline personality disorder features (Whiteside and Lynam 2005). The UPPS dimension ‘urgency’ was found to be associated with negative effects such as a poor sense of self and disruptions in thinking, the dimension ‘premeditation’ is positively associated with energetic affects or forth effort and completing activities can be disturbed by a lack of perseverance, whereas seeking for sensations generates positive effects and leads to enjoying oneself (Sperry et al. 2016). It was also reported that impulsiveness is associated positively with sadistic and passive-aggressive personality disorders and indecisiveness (Barkley-Levenson and Fox 2016; Velotti and Garofalo 2015), whereas the often-reported negative correlations between impulsiveness and intelligence might be due to a negative effect of an individual’s impulsiveness on his or her learning abilities during an intelligence test administration or a

lack of self-control in less intelligent individuals (Lozano 2015; Meldrum et al. 2017).

Worldwide Application of the BIS

The Barratt Impulsiveness Scale is one of the most widely used instrument to measure impulsiveness. It was created by Ernest S. Barratt in 1959, then revised several times until the (most recent) eleventh version in 2009 (BIS; latest version BIS-11; Barratt 1959; Patton et al. 1995; Stanford et al. 2009). The BIS-11 was originally focused on the effects of impulsiveness on psychomotor efficiency, more precisely “as a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individuals or to others” (Moeller et al. 2001). As one of the longest and most commonly used self-report instruments of impulsiveness, one which has had a strong impact on the conceptualization of impulsiveness, the Barratt Impulsiveness Scale has been applied in many different nations. But mostly it has been limited to samples from the Western World. A meta-analysis on sex-differences by Cross et al. (2011) reported 184 applications to samples from the USA, Canada or Central America, 115 from the United Kingdom, Europe, Australia or New Zealand, but only 11 from other geographical areas. Thus, the cross-cultural generalizability of the scale is not conclusively examined. The present study was conducted to contribute to the worldwide availability of BIS data by providing results from two applications in the Arab World, Egypt and Saudi Arabia, and by comparing them with samples from two typical Western countries with particular attention to sex-differences. We chose to focus on sex differences because, in Western samples, males are consistently found to score higher on impulsivity than are females.

Differences in BIS-11 Scores

Across all the studies reviewed, Cross et al. (2011) reported a weak and non-significant effect-size of sex $d = 0.11$ to 0.12 on general measures of impulsivity by BIS-11 and $d = 0.08$ to 0.15 on measurements of BIS sub-domains. The Big Five personality dimension conscientiousness describes, among other things, the ability to impulse control but no effect ($d = 0.06$) of sex on conscientiousness was found by Weisberg et al. (2011), however a significantly higher score in favor of women in the impulsiveness related dimensions extraversion ($d = 0.08$) and neuroticism ($d = 0.39$). On the other hand, impulsiveness was described as the decisive factor leading from high anger to physical violence (Ammerman et al. 2015) and to reactive and proactive aggression (Hecht and Latzman 2015), and males were much more involved as offenders in criminal behavior than females across many countries (Simon and Baxter 1989) or participating more often in aggressive

pastimes (Harris et al. 2006), a significantly higher score would have been expected for males than females.

Furthermore, significant sex differences in various measurements of impulsivity in favor of males were found across different cultures. Representative studies are the Behavior Problems Index by Chapple and Johnson (2007) in a sample of US children from the National Longitudinal Survey of Youth (NLSY79), the Infant-Toddler social and emotional Assessment J-ITSEA by Yago et al. (2015) for Japanese toddlers, by Hadiyono and Kahn (2010) for both American and Indonesian students, the Attention Deficit/Hyperactivity Rating Scale-IV by Magnússon et al. (1999) for Icelandic children, and the Child and Adolescent Disruptive Behavior Inventory-Parent Version (CADBI-P) by Burns et al. (2006) for both American and Malaysian children. Brewis et al. (2003) reported higher scores for girls than boys in impulse control measured by the Test of Variable Attention (TOVA) in a US sample but no sex differences in a Mexican sample. However, the BPI and the I-ITSEA focused both on childhood behavior problems (Peterson and Zill 1986; National Longitudinal Surveys 2017; Yago et al. 2015), the Attention Deficit/Hyperactivity Rating Scale-IV, the CADBI-P and the TOVA focused on symptoms of ADHS/ADHD (Magnússon et al. 1999; Burns et al. 2006; Brewis et al. 2003), therefore the differences in the concepts of impulsiveness prevent the transferring of the findings to the BIS due to the lack of empirical evidence.

Moderate to small significant effect sizes were found for geographical areas on total BIS-11 scores, in particular $d = 0.18$ for "US, Canada & Central America", $d = 0.05$ for "UK, Europe & Aus/NZ", and $d = 0.04$ for "Asia, Africa, Middle East", and on the non-planning BIS sub-domain of $d = 0.30$ for "US, Canada & Central America" and $d = 0.02$ for "UK, Europe & Aus/NZ". Additional cultural differences for BIS-11 mean scores had been found by Chahin et al. (2010) between Columbians and Spanish children. The former (Columbians) were rated higher in sub-domains motor ($d = 0.22$) and lack of planning ($d = 0.43$), but there was no group-difference on factor structure. Cozzi et al. (2013) estimated higher impulsivity, defined by temperament, in Italian toddlers compared to US toddlers with the Early Childhood Behavior Questionnaire (ECBQ; Putnam et al. 2006); but Eysenck and Jamison (1986) could not find significant sex differences in impulsivity between American and British children with the Junior Eysenck Personality Questionnaire (J.EPQ), where impulsiveness was defined as including psychotism, neuroticism and deficiency in social desirability.

Primary Aims

The primary aim of this study was to estimate scores of impulsiveness on the BIS-11 in two Arab countries: Saudi Arabia and Egypt. Simultaneously, differences in impulsivity between demographically comparable samples from the Arab

and the Western World as well as between males and females within these sample were examined by the BSI-11.

Method

Samples

The Egyptian sample was drawn from a university department of Education and Arts in Egypt. The total sample of 450 students consisting 237 female and 213 male students, with a mean age of 20.1 years ($SD = 1.0$). The Saudi sample of 396 university students was from a college for Education in Saudi Arabia and contained 206 female and 190 male students with a mean age of 21.2 years ($SD = 1.9$). Thus, the gender ratio in both samples is almost balanced. At both universities, participation took place randomly and on a voluntary basis without payment. Students were tested in their classrooms after agreeing in writing to participate in the study.

Western samples were taken from the published literature. The US-sample from Stanford et al. (2009) is a combination of two samples. The first contains college students ($N = 1178$; 75%), the second healthy adults ($N = 399$; 25%); in total $N = 1577$ younger and older adults with 393 (25%) males and 1184 females (75%) between 17 and 45 years but a mean age of 21.6 years and therefore most representative for young adults. College students outweigh older adults by a ratio of around 3/1 and the mean ages differences to current study are 1.5 years (USA vs. Egypt) and 0.4 years (USA vs. Saudi Arabia). This made the sample from Stanford et al. (2009) suitable for comparison with the two samples from the Middle East but uneven sex ration in the US-sample have to be borne in mind. The German sample from Malesza and Ostaszewski (2016) contains 298 German university students with 138 males and 160 females between 18 and 29 years old and with a mean age of 21.8. The sex ratio is nearly balanced (46% and 54%) and the differences between mean ages are 1.8 years (Germany vs. Egypt) and 0.7 years (Germany vs. Saudi Arabia).

The potential effects of the differences in samples' sex ratios on BIS-11 scores had to be overcome by calculating scores for total samples (males + females) as unweighted means. For instance, the given total sample scores from Stanford et al. (2009) and Malesza and Ostaszewski (2016) were arranged by gender and were therefore replaced in this study by non-arranged re-estimations (unweighted means).

Measurement of Impulsivity

At the time this study was started the BIS-11 was the only instrument to measure impulsiveness which was available in Arabic. It uses 30 items grouped into first and second order subscales and sums up second order factors into a total score. The first order subscales measure the factors: (1) attention by

five items, (2) motor by seven, (3) self-control by six, (4) cognitive complexity by five, (5) perseverance by four, and (6) cognitive instability by three. The second order subscales measure the traits: Attentional impulsiveness by eight items ($1 + 6$), motor impulsiveness by eleven ($2 + 5$), and non-planning impulsiveness by eleven ($3 + 4$). Finally, a total score was calculated as the sum of all six first order factors. Stanford et al. (2009) successfully proved the internal consistency and the test-retest reliability of the BIS with a Cronbach's α and Spearman's ρ of .83 for the total score. The suitability of the BIS-11 for identification of impulsive individuals and for the detection of individual personality differences was also successfully tested in comparison to other measurements of the same traits by Kulendran et al. (2016) and by Moreno et al. (2011).

In this study the Arabic BIS-11 was used to measure impulsiveness. It was translated in 2010 from English to dialectal Arabic by an expert in English language and later re-translated to English by another person (Ellouze et al. 2013). The re-translated version was then compared with the original English version and no clear differences could be detected between the two. The reliability of the Arabic BIS-11 obtained a Cronbach's α based on standardized items of .78 for the total score, .66 for attention, .72 for motor impulsivity and .61 for lack of planning. Significant correlations between impulsiveness and demographic variables were not reported. We tested the reliability of the BIS-11 again by using the new samples.

For the present study, Egyptian students were tested in 2016 and Saudi students during the second semester in 2015/16, in sessions of about 15 to 20 min by a pen and paper test.

Cross-Cultural Comparison

Based on the cultural comparison in impulsiveness in four cases, first of all it is important to determine the cultural relationship between the four cases. We would assume that cultural differences between Saudi Arabia and Egypt or between Germany and USA are smaller than between the other two pairings. Common histories and religions, similar climatic conditions, and geographical proximities would support this assumption. But concrete measurements of cultural dimensions are characterized by a more differentiated picture, as culture is defined as "the collective programming of the mind distinguishing the members of one group or category of people from others" (The Hofstede Center 2017). This concept measures national culture on six dimensions: power distance (PDI), individualism (IDV), masculinity (MAS), uncertainty avoidance (UAI), long term orientation (LTO) and indulgence (IND). By using national scores from the website of The Hofstede Center (2017; <https://geert-hofstede.com/national-culture.html>), we observed whether and how differences in impulsiveness reflect cultural differences. According to the definition of culture above, we would hypothesize that

"collective programming" is a result of summarized individual programming, therefore it is measurable by means of individual psychological traits, such as impulsiveness.

To quantify such a relationship, a correlation analysis was carried out between absolute differences in scores for cultural dimensions and absolute differences in impulsiveness by comparing first and second order factors and the total score of the BIS-11 with each cultural dimension across the six displayed national pairings ($N=6$: Egypt vs. Saudi Arabia; Egypt vs. Germany; Egypt vs. USA; Saudi Arabia vs. Germany; Saudi Arabia vs. USA; Germany vs. United States). The advantage of correlating score differences against scores themselves is that the study would obtain a higher number of cases ($N=6$ country pairings instead of 4 single countries). Differences were taken in absolute numbers to focus on the question of whether bigger differences in the BIS-11 factors caused smaller differences on the cultural dimensions (or vice versa). If non-absolute numbers were used, it would be more difficult to recognize whether it is that bigger differences caused smaller differences or that bigger differences in one direction caused bigger differences in the other direction.

Note on Interpretation

Cohen's d was used to estimate effect size of differences in mean scores between males and females within every cultural samples and within cross-cultural comparison. We decided to use alternative and more critical conventions for interpretation of effect-sizes, in this case Cohen's d , suggested by Ferguson (2009). These are $(-)0.41$ to declare an effect as significant, $(-)1.15$ as moderate, and $(-)2.70$ as strong. The reasons behind this decision were the acceptable but not so adequate Cronbach's α of the BIS-11 and the missing comparative studies with samples from Egyptian or Saudi culture. Alternative conventions should help to avoid premature conclusions from the results.

Results

Cronbach's α

The reliability of the BIS-11 estimated by the use of the answers given by the samples from Egypt and Saudi Arabia is overall good and comparable to the reliability estimated by Ellouze et al. (2013). Cronbach's α is between .74 and .76 for the total score (Table 1). However, strong variations were found between the factors and also between the samples with, in part, extremely low values, especially for cognitive complexity (.19 to .31) and perseverance (.06 to .34). These findings must be considered when evaluating the results.

Table 1 Cronbach's α values for first- and second order factors of the BIS-11 from the combined and the separated samples used in this study

Factors		Samples		
Order	Scale	EGY + SAU	EGY	SAU
First	Attention	.46	.62	.23
	Motor	.65	.52	.71
	Self-control	.43	.60	.16
	Cognitive complexity	.21	.19	.31
	Perseverance	.23	.06	.34
	Cognitive instability	.39	.36	.46
Second	Cognitive impulsiveness	.56	.65	.43
	Motor impulsiveness	.66	.53	.70
	Non-planning impulsiveness	.39	.52	.32
	Total	.76	.75	.74

Descriptive Statistics

Table 2 shows descriptive statistics of the two new samples (Egypt + Saudi Arabia) and of the two cited studies (Germany + USA). Malesza and Ostaszewski (2016) only gave scores

for first order factors, therefore scores for second order factors had to be calculated by ourselves. A calculation of standard deviations for second order factors of this sample was impossible. To avoid errors due to unequal methods, the scores provided for second order factors of USA had to be replaced by scores re-estimated by ourselves. Sex-ratio varies between countries. To keep data comparable across countries, all full sample scores were calculated as unweighted means.

Sex Differences

The extent and effect sizes of sex differences can be seen in Table 3. Only a small numbers of sex differences reached significance and even these were weak. In the Egyptian sample, self-control ($\Delta = -1.85$; $d = -0.55$) and non-planning impulsiveness ($\Delta = -2.77$; $d = -0.61$) were significantly higher in females than males. In the Saudi sample, perseverance ($\Delta = 1.15$; $d = 0.52$), motor impulsiveness ($\Delta = 2.27$; $d = 0.46$) and also the total score ($\Delta = 4.48$; $d = 0.44$) were significantly higher in males than females. In the German

Table 2 Descriptive statistics of main results of the Egyptian ($N = 213$ males +237 females) and Saudi ($N = 190$ males +206 females) sample

Factors		Sex	EGY		SAU		DEU		USA	
Order	Scale		M	SD	M	SD	M	SD	M	SD
First	Attention	Males	10.21	3.11	11.72	4.35	11.08	2.31	10.30	2.80
		Females	10.19	2.52	10.91	2.67	12.90	3.08	10.40	2.90
		Full	10.20	2.82	11.32	3.51	11.99	2.70	10.35	2.85
	Motor	Males	13.87	3.59	16.02	5.05	18.57	6.45	15.20	2.80
		Females	13.90	3.31	15.30	4.48	16.23	4.60	15.00	3.40
		Full	13.89	3.45	15.66	4.77	17.40	5.53	15.10	3.10
	Self-control	Males	11.19	3.53	14.18	3.76	11.63	4.60	12.40	3.10
		Females	13.04	3.20	14.32	3.16	12.77	3.90	12.00	3.30
		Full	12.12	3.37	14.25	3.46	12.20	4.25	12.20	3.20
	Cognitive complexity	Males	11.54	2.50	11.68	3.31	13.75	5.35	11.30	2.40
		Females	12.46	2.49	10.63	2.70	13.25	5.62	11.60	2.60
		Full	12.00	2.50	11.16	3.01	13.50	5.49	11.45	2.50
	Perseverance	Males	6.99	1.93	9.53	2.51	7.28	2.93	7.20	1.80
		Females	6.86	1.75	8.38	1.88	6.59	2.24	6.80	1.70
		Full	6.93	1.84	8.96	2.20	6.94	2.59	7.00	1.75
	Cognitive instability	Males	7.44	1.97	7.53	2.18	4.13	1.16	6.40	1.80
		Females	7.13	1.91	7.51	1.87	4.94	2.02	6.30	1.90
		Full	7.29	1.94	7.52	2.03	4.54	1.59	6.35	1.85
Second	Cognitive impulsiveness	Males	17.65	4.35	19.85	4.40	15.21	n.d.	16.80	3.90
		Females	17.31	3.61	18.65	3.04	17.84	n.d.	16.70	4.10
		Full	17.48	3.98	19.25	3.72	16.53	n.d.	16.75	4.00
	Motor impulsiveness	Males	20.86	4.51	26.23	5.34	25.85	n.d.	22.40	3.40
		Females	20.78	4.21	23.96	4.63	22.82	n.d.	21.80	4.10
		Full	20.82	4.36	25.10	4.99	24.34	n.d.	22.10	3.75
	Non-planning impulsiveness	Males	22.73	4.77	26.32	4.56	25.38	n.d.	23.60	4.50
		Females	25.50	4.24	25.33	3.67	26.02	n.d.	23.60	5.00
		Full	24.12	4.51	25.83	4.12	25.70	n.d.	23.60	4.75
	Total score	Males	61.24	11.09	72.41	11.58	66.44	n.d.	62.80	9.20
		Females	63.59	9.19	67.93	8.60	66.68	n.d.	62.10	10.60
		Full	62.42	10.14	70.17	10.09	66.56	n.d.	62.45	9.90

Scores of first order factors of German sample ($N = 130$ males +168 females) from Malesza and Ostaszewski (2016) and of US-sample ($N = 393$ males +1184 females) from Stanford et al. (2009). Scores of second order factors (incl. Total score) of German and US-sample were re-estimated from first order factors. All scores of full samples were calculated from data for males and females as unweighted means

Table 3 Differences between and effect sizes of sexes in all four samples

Factors		EGY		SAU		DEU		USA	
Order	Scale	Δ	d	Δ	d	Δ	d	Δ	d
First	Attention	0.02	0.01	0.81	0.23	-1.82	-0.68	-0.10	-0.04
	Motor	-0.03	-0.01	0.72	0.15	2.34	0.42	0.20	0.06
	Self-control	-1.85	-0.55	-0.14	-0.04	-1.14	-0.27	0.40	0.13
	Cognitive complexity	-0.92	-0.37	1.05	0.35	0.50	0.09	-0.30	-0.12
	Perseverance	0.13	0.07	1.15	0.52	0.69	0.27	0.40	0.23
	Cognitive instability	0.31	0.16	0.02	0.01	-0.81	-0.51	0.10	0.05
Second	Cognitive impulsiveness	0.34	0.09	1.20	0.32	-2.63	n.d.	0.10	0.03
	Motor impulsiveness	0.08	0.02	2.27	0.46	3.03	n.d.	0.60	0.16
	Non-planning impulsiveness	-2.77	-0.61	0.99	0.24	-0.64	n.d.	0.00	0.00
	Total score	-2.35	-0.23	4.48	0.44	-0.24	n.d.	0.70	0.07

Positive signs represent higher scores for males. Bold numbers achieve significance. The lowest threshold for significance of Cohen's d was set to ($-$)0.41 according to Ferguson (2009)

sample, a significant effect size in favor of females can be found for attention ($\Delta = -1.82$; $d = -0.68$) and cognitive instability ($\Delta = -0.81$; $d = -0.51$). Missing standard deviations for second order factors from Malesza and Ostaszewski (2016) hindered calculations of Cohen's d . No significant effect sizes could be found in the US-sample. In our cross-national comparison of sex differences and effect sizes, no robust pattern was detectable.

As predicted, correlations between male and female first order factor scores ($N = 6$) were very strong and positive. The highest correlation was calculated in the US-sample ($r = .99$) followed by the Egyptian sample ($r = .97$) followed by the German sample ($r = .96$) and last the Saudi Arabian sample ($r = .90$), all with two-tailed $p < .05$.

Cross-Cultural Differences

Table 4 shows the scores for cultural dimension from The Hofstede Center (2017) and the following analysis is based on it (see 2.3 for details). We found a continuous development from one Western country along another Western country to Arabian countries in four

dimensions. This is an increase in the case of the PDI-dimension (Germany = 35; USA = 40; Egypt = 70; Saudi Arabia = 95) and the UAI-dimension (USA = 46; Germany = 65; Egypt and Saudi Arabia = 80), and a decrease in the case of the MAS-dimension (Germany = 66; USA = 62; Egypt = 60; Saudi Arabia = 45) and the IDV-dimension (USA = 91; Germany = 67; Egypt and Saudi Arabia = 25). Furthermore, score differences are smaller within the Arabian pairing and the Western pairing than between the two closest countries from both pairings in the case of the PDI-dimension (Egypt – Saudi Arabia = 25; Germany – USA = 5; Egypt – USA = 30) and the IDV-dimension (Egypt – Saudi Arabia = 0; Germany – USA = 24; Egypt or Saudi Arabia – USA = 42) and additionally in the UAI-dimension the difference is 0 between Saudi Arabia and Egypt. All these patterns would confirm the assumption in 2.3 but there are also findings that are incongruous with it. In the case of the LTO-dimension, Egypt is closer to USA ($|7–26| = 19$) than to Saudi Arabia ($|7–36| = 29$), and Germany is closer to Saudi Arabia ($|83–36| = 47$) than to USA ($|83–26| = 57$). The same pattern can be seen in the case of the IND-dimension where Egypt is closer to Germany ($|4–40| = 36$) than to Saudi Arabia ($|4–52| = 48$) and USA is closer to Saudi Arabia ($|68–52| = 16$) than to Germany ($|68–40| = 28$). The small amount of cases (4) makes all correlations between countries and across dimensions insignificant. In summary, a strong cultural relationship between Egypt and Saudi Arabia is confirmed by Hofstede's dimensions, but is only partly confirmed between Germany and USA.

The extent of and effect sizes on cultural differences in impulsiveness in a comparison of each with each country can be seen in Table 5. In these comparisons,

Table 4 Scores for six cultural dimensions by The Hofstede Center for four counties

Hofstede's cultural dimensions	EGY	SAU	DEU	USA
Power Distance	70	95	35	40
Individualism	25	25	67	91
Masculinity	45	60	66	62
Uncertainty Avoidance	80	80	65	46
Long Term Orientation	7	36	83	26
Indulgence	4	52	40	68

Table 5 Differences and effect sizes of cultural differences in national pairings

BIS - Factors		EGY vs. SAU		EGY vs. DEU		EGY vs. USA		SAU vs. DEU		SAU vs. USA		DEU vs. USA	
Order	Scale	Δ	d	Δ	d	Δ	d	Δ	d	Δ	d	Δ	d
First	Attention	-1.12	-0.35	-1.79	-0.65	-0.15	-0.05	-0.67	-0.22	0.97	0.30	1.64	0.59
	Motor	-1.78	-0.43	-3.52	-0.78	-1.22	-0.37	-1.74	-0.34	0.56	0.14	2.30	0.53
	Self-control	-2.14	-0.63	-0.09	-0.02	-0.09	-0.03	2.05	0.53	2.05	0.62	0.00	0.00
	Cognitive complexity	0.84	0.31	-1.50	-0.38	0.55	0.22	-2.35	-0.55	-0.29	-0.11	2.05	0.51
	Perseverance	-2.03	-1.01	-0.01	0.00	-0.07	-0.04	2.02	0.85	1.96	0.99	-0.06	-0.03
	Cognitive instability	-0.23	-0.12	2.75	1.56	0.94	0.49	2.99	1.65	1.17	0.60	-1.82	-1.06
Second	Cognitive impulsive-ness	-1.77	-0.46	0.95	n.d.	0.73	0.18	2.73	n.d.	2.50	0.65	-0.23	n.d.
	Motor impulsive-ness	-4.28	-0.91	-3.52	n.d.	-1.28	-0.32	0.76	n.d.	3.00	0.69	2.24	n.d.
	Non-planning impulsive-ness	-1.71	-0.40	-1.59	n.d.	0.52	0.11	0.12	n.d.	2.23	0.50	2.10	n.d.
	Total score	-7.76	-0.77	-4.15	n.d.	-0.03	0.00	3.61	n.d.	7.72	0.77	4.11	n.d.

Positive signs represent higher scores for the first named country. Bold numbers achieve significance. The lowest threshold for significance of Cohen's d was set to ($-$) 0.41 according to Ferguson (2009)

there was a higher number of significant effect sizes ascertainable than for the sex differences, and effect sizes were stronger in many cases. Focused on the total scores, differences between Egypt and Saudi Arabia significantly favored the latter ($\Delta = -7.76$; $d = -0.77$) but no significant effects could be found between Egypt and USA ($\Delta = -0.03$; $d = 0.00$). The total score comparison between Egypt and Germany was not possible. But for differences between them, Germany has significant and higher scores in attention, motor and cognitive instability. Significant positive effect sizes were found in the comparison between Saudi Arabia and Germany and largely referred to Saudi Arabia in self-control, perseverance and cognitive instability, while a significant negative effect size was found in the case of cognitive complexity. Saudi Arabia also shows higher scores and significant effect sizes in comparison to USA in the case of self-control, perseverance and cognitive instability, and all second order factors including the total score ($\Delta = 7.72$; $d = 0.77$). In the comparison between Germany and USA, significant and positive effect sizes in favor of Germany were found in the case of attention, motor and cognitive complexity, but a significant and negative effect size in the case of cognitive instability was discerned.

Table 6 shows results of the correlation analysis between absolute differences in cultural dimensions scores from Table 4 and absolute differences in impulsiveness from Table 5 across the six national pairings. Significant correlations are very rare. PDI is negatively related to cognitive impulsiveness ($r = .88$). LTO is positively related to motor ($r = .96$) and cognitive complexity ($r = .75$). If the significance criterion remains unconsidered, only 18 correlations are positive, but the rest are negative, it would result in a negative mean correlation of $r = -.12$.

Discussion

Looking first at the sex differences, our findings contradict the theoretical assumptions of higher impulsiveness in males but are consistent with those from the meta-analysis by Cross et al. (2011). There, the effect sizes were low and non-significant for the BIS-total score, all three second order factors and the measurement of punishment sensitivity. Although quite significant effect sizes were found in the present study, they are not robust across the samples from different countries. Strictly speaking, not a single significant effect size for sex in the total score or a first/s order factor of the BIS-11 occurred in more than one sample. One way to explain this could be, if there should be a connection between impulsiveness and criminal behavior, then neither decisive factor of impulsiveness is measured by the BIS-11. However, literature confirms the opposite (Barratt et al. 1997; Perley-Robertson et al. 2016; Pechorro et al. 2017). Alternatively, it could be argued that the effect is indirect and moderated by another factor that is independent of impulsiveness.

The cross-cultural pattern of impulsiveness was surprising, as it contradicts superficial cultural divisions, which underlines the relevance of more complex systematics for cultural groups. The differences in impulsiveness in general or the different factors of the BIS-11 occurred unsystematically between the four nations compared and the dividing line does not run between the Western World and the Arab World. Instead, specific cultural aspects seem more important but difficult to explain. Hofstede's cultural dimension of power distance seems to be associated with cognitive impulsiveness. Power distance describes the willingness of weaker members of a society to accept unequal distributions

Table 6 Correlations between absolute differences in cultural dimension and absolute differences BIS-11 factors across six possible pairings of EGY, SAU, DEU and USA

BIS - Factors		Power Distance	Individualism	Masculinity	Uncertainty Avoidance	Long Term Orientation	Indulgence
Order	Scale						
First	Attention	-.40	-.48	.03	-.44	.72	-.31
	Motor	-.37	-.40	.55	-.52	.96	.06
	Self-control	.63	-.18	-.41	-.28	-.49	-.45
	Cognitive complexity	-.10	-.35	-.18	-.42	.75	-.46
	Perseverance	.62	-.19	-.44	-.28	-.49	-.47
	Cognitive instability	.34	.20	-.06	-.01	.72	-.57
Second	Cognitive impulsiveness	.88	.13	-.38	-.07	-.39	-.58
	Motor impulsiveness	-.27	-.51	.31	-.48	.07	.16
	Non-planning impulsiveness	-.40	-.25	-.24	-.04	.00	-.15
	Total score	.15	-.43	-.34	-.40	-.18	-.44

Bold numbers are significant at the $p < .05$ level

of power whereas cognitive impulsiveness describes the tendency to making quick decisions. It seems unlikely that a situational and short-term behavior is in some way related to the capture of abstract signs of more complex social conditions. Thus, our finding may simply be an artifact caused by the small number of observations. The same applies to the statistical relationship found between long term orientation and motor impulsivity. The first describes a stronger or weaker future orientation whereas the second refers to operations of the motor system. On the other hand, a relationship between long term orientation and cognitive complexity, which describes the automotive power when solving difficult problems, seems obvious, as long-term planning is positively associated with cognitive ability at the cross-national level (Jones 2011; Meisenberg and Woodley 2013). Individuals in cultures with a stronger tendency towards long term planning should also show more readiness to solve more complex problems. However, the relatively weak reliability for cognitive complexity found in both samples makes these findings doubtful.

Also, it should be noted that all the samples, both those we used for the measurements and the comparative samples, are only conditionally representative for whole populations. Participants were mostly students from higher education, more precisely universities, hence a preselection according to higher cognitive abilities, educationally friendly personality and behavior had taken place. Unfortunately, there is no literature that has examined possible associations between impulsiveness from the BIS-11 and educational grades, so we cannot quantify the amount of distortion caused by this preselection. A second limitation could occur by using the

thresholds by Ferguson (2009), which declared many effect sizes as insignificant which would have been declared as significant with less stringent benchmarks.

This study was designed to track sex differences and cultural differences in two under-researched Arab countries, to bring greater cultural diversity into the available literature and further meta-analyzes. We hope it fulfills these purposes and also stimulates more intense and wider cross-cultural applications of impulsiveness scales and to compare results in cross-cultural analysis. The latter has already been done for psychological constructs as intelligence and Big Five personality dimension (Lynn and Vanhanen 2012; Schmitt et al. 2008) and should be expanded to impulsiveness.

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Compliance with Ethical Standards

Conflict of Interest Statement The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethic Approval This study was approved by the Research Ethics Committee at the King Saud University.

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