Asian Social Science; Vol. 12, No. 8; 2016
ISSN 1911-2017 E-ISSN 1911-2025
Published by Canadian Center of Science and Education

Evaluation of Hajj Instrument (HAJI) Psychometric Properties Using Rasch Measurement

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Received: May 14, 2016 Accepted: May 26, 2016 Online Published: July 7, 2016

doi:10.5539/ass.v12n8p212 URL: http://dx.doi.org/10.5539/ass.v12n8p212

Abstract

Hajj Instrument (HAJI) was developed to determine hajj pilgrim's wellness. This study used Rasch measurement to evaluate the psychometric properties including validity and reliability of the HAJI. The respondents involved in this study were 300 comprised of Malaysian hajj pilgrims. HAJI consists of eight constructs namely physical care, physical activity, healthy eating, knowledge, mental toughness, intrapersonal, interpersonal and relationship with Creator and natures. Validity of each construct and content was determined through dimensionality, item fit and item polarity while the reliability was achieved by administered person and item separation. The results showed that the reliability for both item and person were 0.99 and 0.96 respectively. Besides, there were no items need to be dropped based on PTMEA CORR and INFIT MNSQ results. The study revealed that the items of HAJI fit the Rasch model as well as able to measure hajj pilgrim's wellness.

Keywords: wellness, hajj, Rasch measurement, validity, reliability

1. Introduction

There are extensive literatures on the definition of wellness but few researches about the wellness assessment (Anspaugh, Hamrick, & Rosato, 2008). Wellness assessment is a tool to assist human in establishing positive lifestyle behaviors, execute early health interventions or reduce other health risks (Haddad, Owies, & Mansour, 2009). Several researchers have discussed on the difficulty of assessing the dynamic nature of wellness as well as insufficiently of the existing measurement tools (Rachele et al., 2013; Renger et al., 2000). There are several methods have been developed to measure wellness such as Life Assessment Questionnaire (LAQ) (Tearnan & Ross, 2012), TestWell (Brown, Applegate, & Yildiz, 2015), Perceived Wellness Survey (Rothmann & Ekkerd, 2007), Optimal Living Profile (von Guenthner & Hammermeister, 2007) and Wellness Inventory (Roscoe, 2009). However, those methods assess wellness in general which means not specific to certain events and age. Therefore, the results will not fully representative the general population and may not accurately address pilgrims' wellness issues or needs at all if use those assessments. Nevertheless, there is argument that some of these assessments have either good reliability or validity (Brent & Carlson, 2014). Thus, study aims to evaluate HAJI reliability and validity in order to be used as a measurement instrument for hajj ritual.

2. Method

This study used questionnaire and were distributed to 300 respondents consist of hajj pilgrims. The respondents were randomly chosen from six mosques which organized Hajj courses in Johor Bahru district. The questionnaire consist of 72 questions that were divided into eight construct namely physical care, physical activity, healthy eating, knowledge, mental toughness, intrapersonal, interpersonal and relationship with Creator and natures. Rasch measurement (RM) was used to analyze the validity and reliability of HAJI based on psychometric standard criteria including item dimensionality, item polarity and item fit analysis. Instrument calibration scale also was administered to assess the suitability of the scale used in HAJI. Four Likert scale was used in HAJI consist of Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1).

3. Findings & Discussion

Validity and reliability of HAJI were analyzed using Winsteps version 3.68.2. The analysis results are as followed.

3.1 Dimensionality Analysis

Dimensionality is important aspect to ensure the HAJI measured in one direction and dimension. Satisfactory dimensionality define by raw variance explained where the recommended value is more than 40% while unexplained variance in 1st contrast value is ≤ 15 (Bond & Fox, 2015; Linacre, 2006). Figure 1 shows the dimensionality of HAJI.

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

		-- Empirical --		Modeled
Total raw variance in observations	=	139.0	100.0%	100.0%
Raw variance explained by measures	=	67.0	48.2%	48.8%
Raw variance explained by persons	=	25.9	18.7%	18.9%
Raw Variance explained by items	=	41.0	29.5%	29.9%
Raw unexplained variance (total)	=	72.0	51.8% 100.0%	51.2%
Unexplned variance in 1st contrast	=	10.5	7.6% 14.6%	
Unexplned variance in 2nd contrast	=	7.2	5.2% 10.0%	
Unexplned variance in 3rd contrast	=	5.6	4.0% 7.8%	
Unexplned variance in 4th contrast	=	5.4	3.9% 7.5%	
Unexplned variance in 5th contrast	=	5.0	3.6% 6.9%	

Figure 1. Analysis of dimensionality

It can be seen in Figure 1 that raw variance explained by measures of HAJI was 48.2% as well as value for unexplained variance was 7.6% which not exceed the RM control limit. This means HAJI have good dimensional characteristic and HAJI constructs was proven to measured only one dimension (Aziz et al., 2008).

3.2 Reliability Analysis

RM analyzes both person and item reliability. Reliability defined as consistency of respondents' answer to the items scale (Mofreh et al., 2014). RM measures reliability including person separation reliability. This statistic shows the ability of the item to separate persons with different levels of the concept measured. According to Linacre (2006) and Bond & Fox (2015), value for accepting reliability in RM is should be more than 0.50 while acceptable separation value should be more than two (Fisher, 2010). Figure 2 and 3 show the item reliability and person reliability respectively.

SUMMARY OF 72 MEASURED ITEM

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	949.9	300.0	.00	.13	.97	-1.1	.96	-1.1
S.D.	94.6	.0	1.38	.01	.45	4.9	.54	4.8
MAX.	1137.0	300.0	6.08	.15	2.36	9.9	2.84	9.9
MIN.	464.0	300.0	-3.30	.10	.35	-9.2	.29	-9.7

REAL RMSE	.14	TRUE SD	1.38	SEPARATION	10.04	ITEM	RELIABILITY	.99
MODEL RMSE	.13	TRUE SD	1.38	SEPARATION	10.71	ITEM	RELIABILITY	.99
S.E. OF ITEM MEAN = .16								

Figure 2. Analysis of item reliability

SUMMARY OF 300 MEASURED PERSON

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	228.0	72.0	2.54	.26	1.03	-.2	.96	-.5
S.D.	22.0	.0	1.47	.02	.58	3.1	.53	2.8
MAX.	276.0	72.0	6.08	.36	2.73	6.9	1.93	4.2
MIN.	194.0	72.0	.32	.24	.19	-6.1	.15	-6.2

REAL RMSE	.30	TRUE SD	1.44	SEPARATION	4.81	PERSON	RELIABILITY	.96
MODEL RMSE	.26	TRUE SD	1.44	SEPARATION	5.48	PERSON	RELIABILITY	.97
S.E. OF PERSON MEAN = .08								

PERSON RAW SCORE-TO-MEASURE CORRELATION = 1.00
CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .97

Figure 3. Analysis of person reliability

Results show that value of item reliability was 0.99 whereas item separation value is more than two (10.04) as shown in Figure 2. While, Figure 3 shows person reliability was 0.96 whereas for the person separation the value was five. Thus, it can be conclude that HAJI has strong and acceptable reliability (≥ 0.8) as suggested by Aziz et al., (2008), Bond & Fox (2015) and Mamat, Maidin, & Mokhtar (2014). This means respondents involved represent actual characters that need to be tested. Besides, result for separation was good and it shows variety of skills in answering HAJI (Smith, 2000).

3.3 Item Polarity Analysis

Item polarity is necessary in measuring the constructs validity. It is similar to factor analysis function where it is used to access the relationship of the items in measuring the construct. The criteria of good correlation are the values PTMEA should be > 0.20 (Bond & Fox, 2015). Table 1 shows there were no value of negative correlation and all PTMEA of each items is > 0.20. This indicates that there are no mistakes in data entry or miscoded items. Table 2 shows the summary of item polarity analysis.

3.4 Item Fit Analysis

In order to analyze appropriateness of HAJI items, each item were analyzed separately. Each measured item shows the information of mean square (MNSQ) which can used to identify misfit item. According to Bond & Fox (2015), acceptance value of MNSQ for infit analysis should be $0.4 < x < 1.5$ and ZSTD values range between -2 and 2. Table 1 shows analysis of item fit for all items. From the table, it can be seen that infit MNSQ values for all items was within the standard range of RM. It means all the 72 items fit the construct and may not be drop. Table 3 shows the summary of item fit analysis.

Table 1. Analysis of item polarity and item fit

Entry Number	Total Score	Total Count	Measure	Model S.E.	Infit		Outfit		PT-Measure		Exact Match		Item
					MNSQ	ZSTD	MNSQ	ZSTD	Corr.	EXP.	OBS %	EXP %	
22	464	300	6.08	.12	1.20	.9	2.33	9.9	.62	.65	43.3	68.3	CN22
13	684	300	3.61	.10	.49	-.56	.79	-.3	.64	.46	60.6	51.0	K13
62	745	300	2.93	.11	1.17	.8	2.53	9.9	.25	.58	31.3	65.2	CN62
2	791	300	2.38	.11	1.10	.7	1.21	.6	.55	.52	33.3	46.9	HE2
37	821	300	2.01	.11	2.03	.99	2.39	9.9	.55	.54	50.7	65.6	MT37
20	829	300	1.91	.11	1.33	1.2	1.04	.3	.76	.46	48.5	50.5	MT20
16	864	300	1.44	.12	.92	0	1.00	.0	.74	.54	73.7	69.7	HE16
36	864	300	1.44	.12	1.19	1.24	1.31	3.1	.81	.54	68.3	69.7	INTER36
38	864	300	1.44	.12	.65	-.46	-.8	-.8	.80	.27	84.8	77.6	K38
3	866	300	1.41	.12	1.17	.7	1.21	.6	.64	.52	33.3	46.9	MT3
9	869	300	1.37	.12	.49	-.56	.75	-.6	.75	.52	45.5	46.8	K9
35	872	300	1.32	.12	1.16	.7	1.30	3.0	.49	.54	74.0	70.5	CN35
21	882	300	1.18	.12	.99	0	1.03	.3	.44	.54	74.0	71.4	CN21
43	892	300	1.03	.12	1.37	1.49	1.38	1.0	.45	.52	21.2	46.8	PA43
15	893	300	1.02	.12	1.09	.7	1.17	.5	.73	.52	48.3	46.9	K15
45	901	300	.89	.12	1.38	1.3	1.02	.2	.54	.37	45.5	59.7	PA45
42	909	300	.77	.13	1.02	.2	6.92	5.6	.62	.45	57.6	51.7	MT42
39	916	300	.66	.13	.87	-.15	.89	-1.0	.60	.55	79.7	74.2	MT39
69	917	300	.64	.13	.65	-.42	.59	-4.8	.84	.55	91.3	74.2	MT69
8	925	300	.51	.13	1.01	.1	.94	-.5	.76	.55	77.0	74.7	INTER8
18	925	300	.51	.13	1.26	1.22	.96	.1	.65	.39	60.6	58.8	K18
14	932	300	.40	.13	1.19	.8	1.13	1.3	.53	.56	74.0	75.1	CN14
11	941	300	.25	.13	1.01	.1	1.00	.1	.60	.56	71.7	75.4	MT11

Entry Number	Total Score	Total Count	Measure	Model S.E.	Infit		Outfit		PT-Measure		Exact Match		Item
					MNSQ	ZSTD	MNSQ	ZSTD	Corr.	EXP.	OBS %	EXP %	
47	950	300	.09	.13	.62	-.43	.62	-4.2	.61	.81	79.7	75.7	MT47
41	951	300	.08	.13	.63	-.72	0.53	-1.1	.54	.48	75.8	48.7	PA41
48	951	300	.08	.13	.92	0	1.30	.7	.71	.24	84.8	83.4	PA48
49	951	300	.08	.13	.89	-.12	.88	-1.1	.68	.58	82.3	75.8	K49
17	952	300	.06	.13	.66	-.40	.65	-3.8	.55	.26	82.7	75.8	MT17
52	952	300	.06	.13	.79	-.23	.76	-2.5	.64	.40	82.7	75.8	K52
67	953	300	.04	.13	.84	-.7	.74	-.4	.80	.47	60.6	49.3	INTER67
19	959	300	-.06	.13	1.20	.9	1.25	.8	.74	.58	45.5	44.5	INTER19
40	959	300	-.06	.13	1.05	.5	.97	-.3	.70	.52	79.7	76.1	K40
68	961	300	-.10	.13	.83	-.6	.77	-2.3	.77	.57	80.3	76.2	HE68
46	967	300	-.20	.13	.95	-.5	.92	-.8	.78	.57	83.0	76.3	PA46
4	968	300	-.22	.13	.79	-.4	.67	-.3.5	.58	.57	82.7	76.3	HE4
23	968	300	-.22	.13	1.01	.1	.97	-.2	.77	.57	72.0	76.3	INTER23
26	968	300	-.22	.13	.70	-.35	.63	-4.1	.76	.52	77.3	76.3	K26
59	976	300	-.36	.13	1.30	1.42	1.28	2.5	.69	.52	68.0	76.2	MT59
31	977	300	-.37	.13	.94	-.73	.93	-.7	.64	.37	75.0	76.2	MT31
51	977	300	-.37	.13	.69	-.37	.64	-3.9	.68	.34	85.7	76.2	MT51
54	978	300	-.39	.13	.81	-.21	.77	-2.3	.61	.36	80.0	76.2	MT54
5	984	300	-.50	.13	.74	-.77	.67	-3.5	.68	.57	83.0	76.2	PC5
10	984	300	-.50	.13	.69	-.39	.62	-4.2	.61	.46	77.7	76.2	MT10
6	985	300	-.51	.13	.70	-.2	.69	-.5	.60	.45	51.5	51.7	HE6
50	985	300	-.51	.13	.76	-.68	.54	-.8	.58	.27	84.8	77.6	HE50
61	985	300	-.51	.13	1.12	1.21	1.11	.4	.64	.26	87.9	81.0	PC61
53	986	300	-.53	.13	.77	-.8	.79	-.3	.73	.45	66.7	52.2	INTER53
55	987	300	-.55	.13	.66	-.41	.60	-4.5	.73	.24	83.3	76.2	MT55
66	987	300	-.55	.13	.69	-.37	.64	-3.9	.60	.53	82.7	76.2	MT66
28	995	300	-.69	.13	.70	-.35	.63	-4.0	.74	.58	80.0	76.0	MT28
44	1000	300	-.78	.13	.68	-.40	.63	-4.0	.64	.46	85.7	75.9	K44
65	1001	300	-.79	.13	.82	-.21	.79	-2.1	.67	.47	80.0	75.9	K65
27	1002	300	-.81	.13	1.41	1.2	1.11	.4	.65	.26	87.9	81.0	PA27
29	1002	300	-.81	.13	.92	0	1.3	.7	.50	.24	84.8	83.4	PC29
70	1002	300	-.81	.13	.70	-.12	.65	-3.9	.69	.57	91.7	75.8	CN70
7	1008	300	-.92	.13	1.40	1.16	1.34	3.0	.38	.57	74.0	75.5	CN7
24	1009	300	-.93	.13	.76	-.16	.66	-3.7	.62	.57	76.7	75.5	CN24
12	1010	300	-.95	.13	1.24	1.0	1.23	2.1	.57	.57	65.7	75.4	CN12
30	1011	300	-.97	.13	.83	-.6	.75	-.6	.57	.52	45.5	46.8	PC30
60	1011	300	-.97	.13	.67	-.93	.66	-.8	.82	.51	39.4	47.0	INTER60
64	1011	300	-.97	.13	.89	-.6	.75	-.6	.73	.52	45.5	46.8	INTER64
32	1019	300	-1.11	.13	.82	-.6	.79	-.3	.76	.46	60.6	51.0	INTRA32

Entry Number	Total Score	Total Count	Measure	Model S.E.	Infit		Outfit		PT-Measure		Exact Match		Item
					MNSQ	ZSTD	MNSQ	ZSTD	Corr.	EXP.	OBS %	EXP %	
33	1019	300	-1.11	.13	.90	0	1.3	.7	.75	.24	84.8	83.4	INTR A33
57	1027	300	-1.25	.13	.54	-.18	.45	-6.4	.76	.45	79.7	74.0	K57
56	1028	300	-1.26	.13	.49	-.58	.54	-5.1	.31	.55	86.0	73.9	CN56
63	1038	300	-1.44	.13	.59	-.18	.59	-1.1	.63	.52	48.5	46.8	PC63
58	1043	300	-1.52	.13	.78	-.18	.69	-3.0	.59	.54	83.3	73.0	CN58
34	1044	300	-1.54	.13	.81	-.89	.79	-.3	.82	.45	66.7	52.2	INTR A34
25	1046	300	-1.58	.13	1.02	.2	6.92	5.6	.78	.45	57.6	51.7	INTR A25
72	1069	300	-1.97	.13	.83	-.6	.79	-.3	.76	.46	60.6	51.0	PC72
71	1095	300	-2.44	.14	1.04	1.13	1.25	.7	.80	.50	21.2	47.4	INTR A71
1	1137	300	-3.30	.15	1.07	1.27	1.54	1.9	.69	.37	73.3	80.0	HE1

Table 2. Analysis of item polarity

No.	Construct	PTMEA CORR	
		Min	Max
1	Physical Activity	0.45	0.78
2	Healthy Eating	0.55	0.77
3	Physical Care	0.50	0.76
4	Intrapersonal Communication	0.75	0.82
5	Interpersonal Communication	0.73	0.82
6	Knowledge	0.64	0.81
7	Relationship with Creator and natures	0.25	0.69
8	Mental Toughness	0.55	0.87

Table 3. Analysis of item fit

No.	Construct	INFIT MNSQ		INFIT ZSTD	
		Min	Max	Min	Max
1	Physical Activity	0.63	1.41	-0.72	1.49
2	Healthy Eating	0.70	1.10	-0.68	1.27
3	Physical Care	0.59	1.12	-0.77	1.21
4	Intrapersonal Communication	0.81	1.04	-0.89	1.13
5	Interpersonal Communication	0.67	1.20	-0.93	1.24
6	Knowledge	0.49	1.26	-0.56	1.22
7	Relationship with Creator and natures	0.49	1.40	-0.58	1.16
8	Mental Toughness	0.62	1.30	-0.73	1.42

3.5 Category Function Analysis

Rasch analysis could validate the scale used by made zero calibration setting. Rasch analysis determines validity of respond possibility to spread fairly between specified scales (Alagumalai, Curtis, & Hungi, 2005; Aziz et al.,

2008; Kassim, 2007). Figure 3 and 4 shows summarized of category function analysis and structured measurement at the intersection point. It can be seen most frequent option answered by respondent was three (13230) following by 4 (6119), 2 (1977) and 1 (274). It can be seen also that respond pattern was normal due to the observed average start from negative logit (-1.92) and end with positive logit (4.56). Lastly, structure calibration is the strength of Rasch measurement model where Rasch solved the gap flexibility problem within the Likert scale range. In this study, the deviation between the scale one and two was 3.31, deviation for two and three was 4 and deviation for three and four was 4.69. This verified that scale used in HAJI is suitable and manage to differentiate by respondent. According to Bond & Fox (2015) value of scale need to be remain if the deviation value is more than 1.4 and less than 5 ($1.4 < s < 5$).

SUMMARY OF CATEGORY STRUCTURE. Model="R"

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
1	1	274	1	-1.92	-3.11	2.08	2.41	NONE	(-4.46)	1
2	2	1977	9	.40	.19	1.19	1.16	-3.31	-2.00	2
3	3	13230	61	2.02	2.16	.90	.79	-.69	1.66	3
4	4	6119	28	4.56	4.38	.85	.83	4.00	(5.10)	4

Figure 4. Analysis of category function

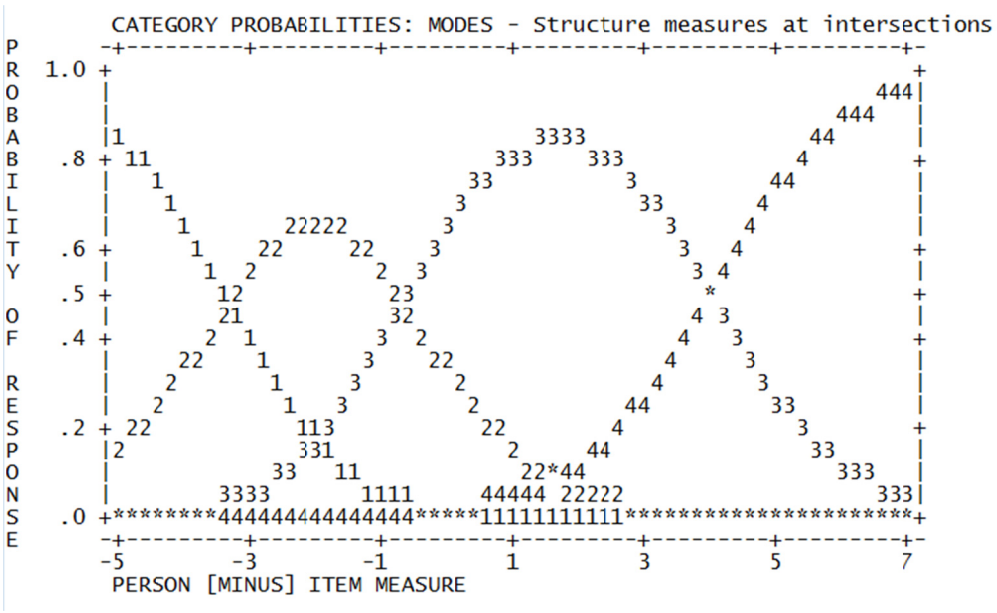

Figure 5. Structured measurement at the intersection point

4. Conclusion

This study used RM to evaluate the psychometric properties of HAJI including reliability and validity. The items were developed based on previous research and expert consult. While for the evaluation of items, researcher used RM. From the findings, HAJI obtained high reliability value and this indicates that HAJI is valid and reliable to measure pilgrim's wellness. Based on the results, item reliability was 0.99 > 0.50, item separation was 10.04 > 2.0, dimensionality exceed the standard range of RM, all PTMEA shows positive value and all 72 items are found to be valid. Thus, this study contributes significantly to the hajj pilgrims and can be used by responsible parties including hajj management and ministry of health to determine hajj pilgrim's wellness.

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