

## Validity and Reliability of The Arabic Version of De Morton Mobility Index after Abdominal Surgeries: A Cross-Sectional Study

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### ABSTRACT

**Background:** Post-abdominal surgery patients often experience decreased mobility, which necessitates precise evaluation tools. The De Morton Mobility Index (DEMMI) is a well-regarded scale for assessing various aspects of mobility. Although validated in several languages, no Arabic version has been reported to date.

**Purpose:** This study aimed to validate and determine the reliability of the Arabic-translated version of DEMMI for Egyptian patients who had undergone abdominal surgeries.

**Methods:** The study was carried out in the following two major steps: The first step involved translating the DEMMI from English to Arabic, looking at both forward and backward translations. Experts thoroughly examined the finalized version to determine its authenticity and the accuracy of its face and content validity. Step 2: Following abdominal procedures, 103 patients of both sexes (62 females and 41 males) had the scale's psychometric properties evaluated. They were between forty and sixty years old. The feasibility of the scale was assessed based on the time required to finish it. The reliability was further evaluated using test-retest reliability and internal consistency. In addition to filling out the index, patients were requested to return it 24 hours later to ensure its test-retest reliability.

**Results:** The Arabic DEMMI demonstrated exceptional face validity, with a clarity index of 96.76% and an average response clarity of 90%. Content validity was high, with an S-CVI value of 0.98. Reliability testing indicated Cronbach's alpha of 0.903, signifying excellent internal consistency. Test-retest reliability was robust, with the overall Intraclass Correlation Coefficient (ICC) at 0.968 (95% CI: 0.953–0.979).

**Conclusion:** The Arabic DEMMI is a reliable, valid, and user-friendly instrument for assessing mobility impairments in patients recovering from abdominal surgeries.

**Keywords:** Arabic, DEMMI, Feasibility, Abdominal Surgeries, Reliability, Validity, Mobility limitation.

### 1. INTRODUCTION

Major abdominal surgery (MAS) encompasses intra-peritoneal procedures that exclude primary thoracic involvement, typically involving luminal or solid organ resection related to the gastrointestinal tract. These surgeries are associated with significant risks, including high morbidity and mortality, and complications tend to be more frequent and severe in emergency cases compared to elective ones. Physiological derangements prior to surgery often exacerbate the postsurgical adverse events observed after emergency laparotomies.[1][2]

Impaired mobility significantly contributes to diminished quality of life and reduced social engagement, particularly in hospitalized patients. Mobility limitations increase the risk of falls, prolonged hospital stays, severe impairments, and higher mortality rates. Reliable assessments of mobility are essential for effective management and recovery strategies. Studies show a strong correlation between delayed mobilization and postoperative complications, particularly pulmonary issues, after high-risk upper abdominal surgeries.[2][3][4]

Morbidity following major abdominal surgery is significant. More than 20% of patients experience postoperative complications that necessitate invasive treatment and significantly raise the risk of subsequent morbidity and death. Cardiopulmonary adverse events are responsible for up to 50% of postoperative problems in upper abdominal surgeries. Pulmonary problems cause considerably higher morbidity, mortality, and duration of hospitalization, particularly subsequent to major upper abdominal surgeries.[5].

Early mobilization plays a pivotal role in Enhanced Recovery After Surgery (ERAS) protocols, emphasizing its role in mitigating risks such as muscle deconditioning, thromboembolic events, and insulin resistance. Despite robust evidence on

the adverse effects of immobility, there remains limited research on structured programs specifically designed to enhance early postoperative mobility.[6][7]

Early mobility and exercise are critical components of postoperative therapy subsequent to abdominal surgeries, since they are related with reduced postsurgical performance impairment and fewer postsurgical problems in individuals receiving elective surgeries.[2]

Instruments like the De Morton Mobility Index (DEMMI), originally developed for older adults, offer a standardized approach to evaluating mobility. However, traditional mobility metrics such as The Timed Up and Go and Six-Minute Walk Test are two regularly utilized assessments, often exhibit ceiling effects, limiting their applicability in diverse patient populations. DEMMI addresses this gap by providing reliable interval-level measurements suitable for acute medical and rehabilitation settings. Its validated versions in multiple languages underline its utility, yet an Arabic adaptation was lacking, prompting this study to fill the gap.[8][3]

A DEMMI score of <40 indicates an independent risk of serious postoperative complications. A low DEMMI score suggested limited mobilization, and prior research of patients following abdominal surgery discovered that delayed mobilization was related with postoperative pulmonary problems.[2]

Poor mobility has a significant influence on individual's ability to perform daily living tasks, engage socially, avoid falls, and maintain quality of life. Hence, improving or maintaining adequate mobility is an essential inter-professional target in rehabilitation. It is advised that health professionals employ assessment tools with high reliability and validity to monitor mobility.[9] Furthermore, prior research has demonstrated strong psychometric qualities in various language versions, indicating that the DEMMI represents an appropriate tool for evaluating patients' mobility function.[3]

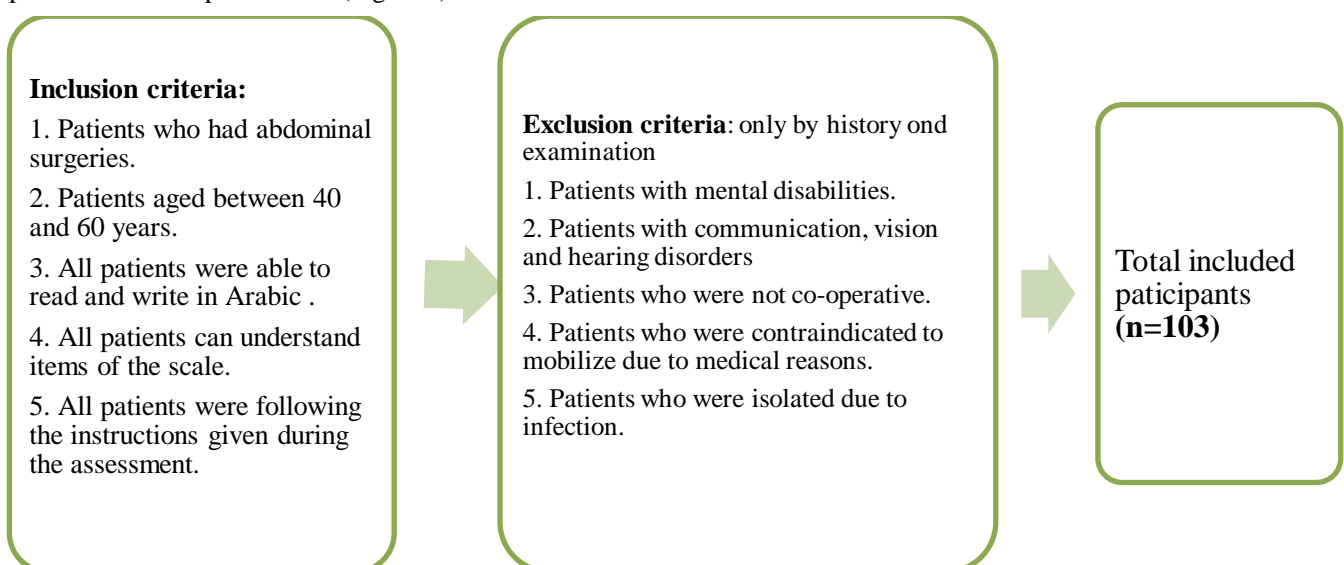
The reliability of the original English version of the DEMMI was evaluated utilizing Pearson's correlation ( $r$ ) between test and retest scores, which proved to be strong ( $r=0.94$ ).[8] The test-retest reliability of the Brazilian Portuguese version was determined to be excellent, with an ICC range of 0.84 to 0.92, which was assessed to be excellent as observed in the German and Dutch.[3]

Accordingly, this study aimed to develop an Arabic version of the DEMMI through translation and cultural adaptation and to examine its psychometric properties, including validity and reliability in patients after abdominal operations. It is translated into many languages but not present in Arabic version form.

## 2. Material and methods

### *Study participants and recruitment criteria:*

This study was conducted between September 2024 and December 2024. A total of 103 participants (41 males and 62 females) aged 40 to 60 years, who had undergone abdominal surgeries, were recruited from Mansoura International Hospital, Mansoura, Egypt. Demographic information was recorded for each participant, and screening was performed to ensure compliance with inclusion and exclusion criteria. Inclusion criteria required participants to have undergone either laparoscopic or laparotomy procedures and to possess the ability to read and comprehend Arabic. Patients with cognitive impairments, communication barriers, who were isolated due to infection, or who had medical contraindications to transfer were excluded. Only history and examination were used to exclude medical problems. Participants' inclusion and exclusion process flowchart presented in (Figure 1).



*Figure (1): Participants' inclusion and exclusion process flowchart.*

### **Sample size:**

The sample size for ICCs was estimated using the formula provided by Walter. Using a minimal acceptable ICC of 0.8, expected ICC of 0.9, significance level of 0.05, statistical power of 95%, and number of repeats two, the minimum necessary sample size is around 103 participants.[10]

### **Design of study:**

An observational, double-center, cross-sectional study aimed to assess the translated De Morton Mobility Index's face and content validity, feasibility, internal consistency, as well as test-retest reliability. Before the study, participants were required to submit written agreements after being fully informed with their consent forms, informing them of their right to refuse or withdraw at any time, as well as about the confidentiality of any obtained information, and ethical approval was obtained from the ethical committee of the Faculty of Physical Therapy at Cairo University (with the reference number P.T.REC/012/005350). The procedures used in this study adhere to the tenets of the Declaration of Helsinki.[11]

### **Procedures:**

The Development and Evaluation of (DEMMI) involved a rigorous translation process. The research was carried out in two stages. The first was the process of translating the original English DEMMI version of the index into two independent Arabic versions in accordance with established rules. These versions were then subjected to back-translation into English by two different translators. This iterative process, guided by the forward-backward translation principles outlined by Sousa resulted in a refined Arabic version of the DEMMI and the second was determining its psychometric properties.[12]

Subsequently, the refined version underwent a series of rigorous evaluations, including pilot testing with professionals and a final validation study with patients, to assess its reliability and feasibility in the Arabic context. To prevent researcher and participant bias, cultural adaptation for the index was done; the researcher asked each issue more than once and in different ways; the researcher did not ask in a leading manner.[13]

The researcher would bring together all translated versions of the scale, generate pre-final scale considerations for field testing, and look for any changes to establish conceptual equivalency (ensuring conceptual meaning for Egyptians). It was strongly advised to engage two expert panels, each consisting of ten specialists, to further analyze the scale.[14]

Their inclusive criteria were experience of at least 10 years or a master's degree. The majority of their work is with the Arabic community; they are fluent in Arabic and English, and both genders included:

- a) One expert panel (ten experts). The scale was tested for clarity of the instructions, items, and responses to format (face validity), and suggestions were made to improve its clarity using dichotomous questions (clear-unclear). [15]
- b) The second expert panel (10 experts) was then asked to evaluate each item of the instrument for content equivalence (content-related validity [relevance]) using the following scale: 1 = not relevant; 2 = unable to assess relevance; 3 = relevant but needs minor alteration; 4 = very relevant.
- c) After the pre-final version passed expert face and content validity tests, the research team collected all of the criticisms from the two expert panels and updated it to the most clear and equivalent formula, which was named the final version.[16]
- d) A pilot study of the final Arabic version of the DE Morton Mobility Index was conducted on five patients After abdominal Surgeries.

This finalized version was then administered to patients to assess its feasibility, including completion time. Additionally, internal consistency reliability was evaluated utilizing Cronbach's alpha coefficient. Test-retest reliability was assessed by administering the index to patients again after 24 hours and comparing mean scores and intraclass correlation coefficients.[17]

### **Data Analysis:**

Numerical data underwent analysis using descriptive statistics, comprising means and standard deviations. Categorical information was summarized through percentages and frequency distributions. Face validity assessment methodologies incorporated Clarity Index calculations and Expert Proportion of Clearance determinations. Content validity evaluation employed multiple metrics: expert relevance proportions, item-level Content Validity Index (CVI), and comprehensive Scale Content Validity Index (S-CVI). Reliability was examined through Cronbach's alpha for internal consistency and the Intraclass Correlation Coefficient (ICC) for test-retest reliability. Feasibility assessment included determining the average completion time and the missing item index. All statistical analyses were conducted using IBM Statistical Package for Social Studies (SPSS) version 25 for Windows, with a significance level of ( $p < 0.05$ ) and 95% confidence interval.

### 3. Results:

#### *Subject characteristics:*

One-hundred and three Egyptian patients after abdominal surgeries were participated in this study and answered the items of DEMMI questionnaire. The mean  $\pm$ SD value of patient's age (years) was  $51.90 \pm 6.50$  years with a minimum value 40.00 years and maximum value 60.00 years (Table 1 and Figure 2). The mean  $\pm$ SD value of patient's BMI ( $\text{kg}/\text{m}^2$ ) was  $30.30 \pm 4.30$  with a minimum value  $21.20 \text{ kg}/\text{m}^2$  and maximum value  $39.80 \text{ kg}/\text{m}^2$  (Table 1 and Figure 3).

Table (1): Demographic data of the patients in study population group (n=103)

Variables	Mean $\pm$ SD	Minimum	Maximum
Age (year)	<b><math>51.90 \pm 6.50</math></b>	<b>40.00</b>	<b>60.00</b>
BMI ( $\text{kg}/\text{m}^2$ )	<b><math>30.30 \pm 4.30</math></b>	<b>21.20</b>	<b>39.80</b>

Data are expressed as mean  $\pm$  standard deviation (SD)

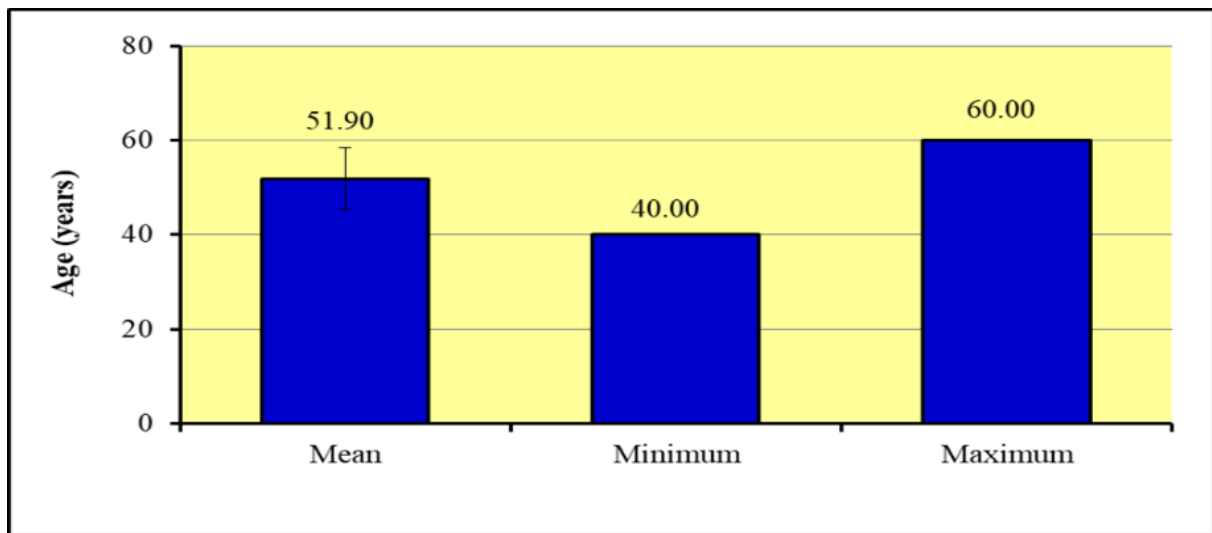


Figure (2): Mean, minimum, and maximum values of patient's age (year) for study population group

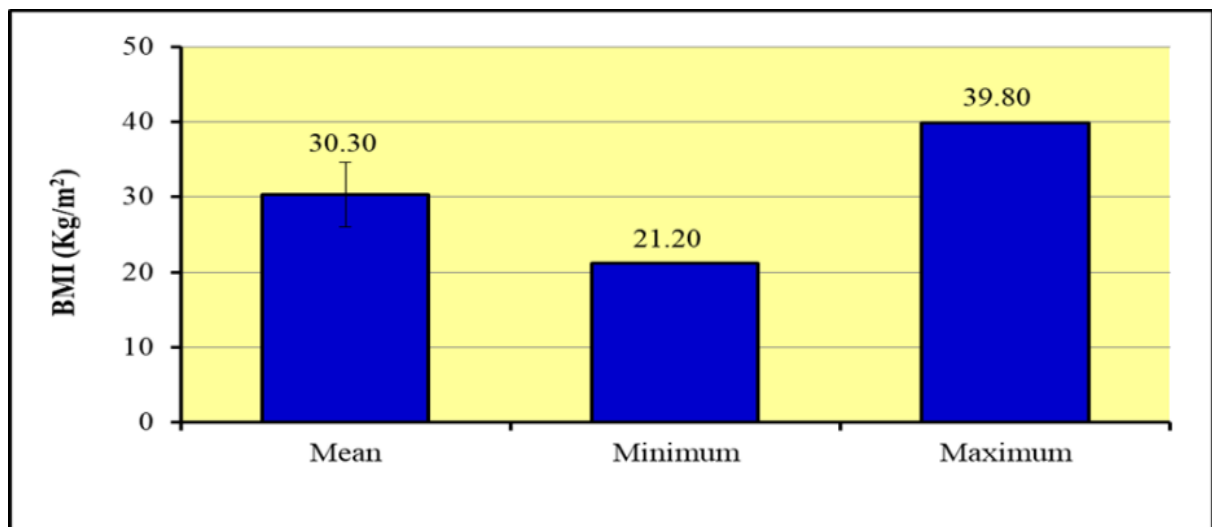


Figure (3): Mean, minimum, and maximum values of patient's BMI ( $\text{kg}/\text{m}^2$ ) for study population group.

The gender distribution (Table 2 and Figure 4) revealed that the study population group consisted of 103 patients after abdominal surgeries, the number (percentage) of males and females were 41 (39.81%) and 62 (60.19%), respectively.

Table (2): Gender distribution in study population group

Items	Gender		Total
	Males	Females	
Frequency	41	62	103
Percentage	39.81%	60.19%	100%

Data are expressed as frequency and percentage

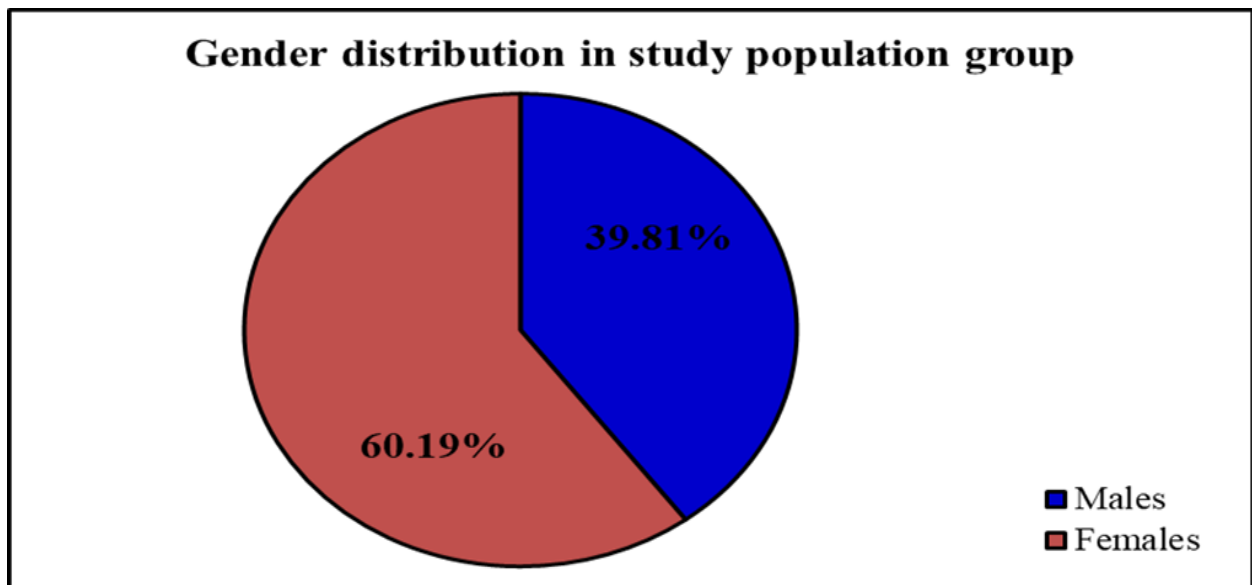


Figure (4): Gender distribution in the study population group.

### Experts Results for DEMMI

#### A. Experts results for Face validity (Panel I)

##### A.1. Descriptive statistics for general characteristics of the experts:

The mean values of experts' experience years are shown in (Table 3 and figure 5). Ten expert physiotherapists whose specialty is rehabilitation of general surgery to test the content validity of the new Arabic version of DEMMI questionnaire. The experience Mean  $\pm$ SD value of 10 expert physiotherapists was 12.80  $\pm$ 8.50 years with minimum value 5.00 years and maximum value 18.00 years of experience.

Table (3): Mean, standard deviation, minimum, and maximum values of experts' experience years

Experts	Years of experience
Number	10.00
Mean $\pm$ SD	12.80 $\pm$ 8.50
Minimum	5.00
Maximum	18.00

Data are expressed as mean  $\pm$ standard deviation (SD)

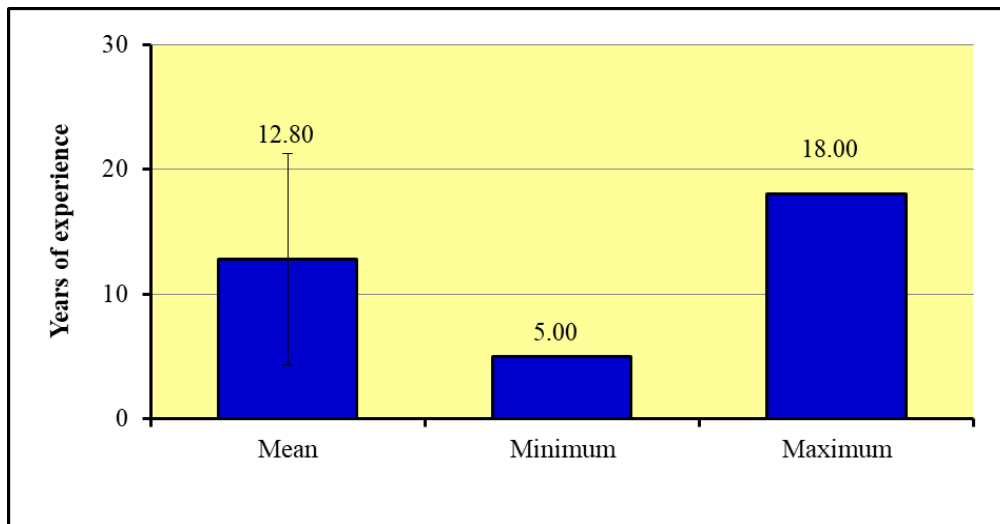


Figure (5): Mean, minimum, and maximum values of experts' experience years

#### A.2.Face validity statistics of the DEMMI:

The expert's opinions according to index of clarity (IC) for DEMMI questionnaire are presented in Table (4). Face validity was measured by IC for the DEMMI, according to the experts' opinions the mean index of clarity of all 15 items was 96.76%. Eleven items were clear, with index of clarity=100%. Items (1), (10), and (12) had index of clarity = 90%. Moreover, item (8) had index of clarity = 80%.

Table (4): Expert's opinions according to index of clarity (IC) of the DEMMI.

Items	Clear	Not clear	Item of IC
Item 1	9	1	90%
Item 2	10	0	100%
Item 3	10	0	100%
Item 4	10	0	100%
Item 5	10	0	100%
Item 6	10	0	100%
Item 7	10	0	100%
Item 8	8	2	80%
Item 9	10	0	100%
Item 10	9	1	90%
Item 11	10	0	100%
Item 12	9	1	90%
Item 13	10	0	100%
Item 14	10	0	100%
Item 15	10	0	100%
Mean IC for all items	9.67	0.33	96.76%

The distribution of 10 experts' academic degree involved in this study to test the face and content validity of DEMMI Arabic version (Table 5 and Figure 6) revealed the number (percentage) of academic degree were 5 M.Sc. (50.00%) and 5 Ph.D. (50.00%).

Table (5): Distribution of experts' academic degrees.

Items	Academic degree		Total
	M.Sc.	Ph.D.	
Frequency	5	5	10
Percentage	50.00%	50.00%	100%

Data are expressed as frequency and percentage

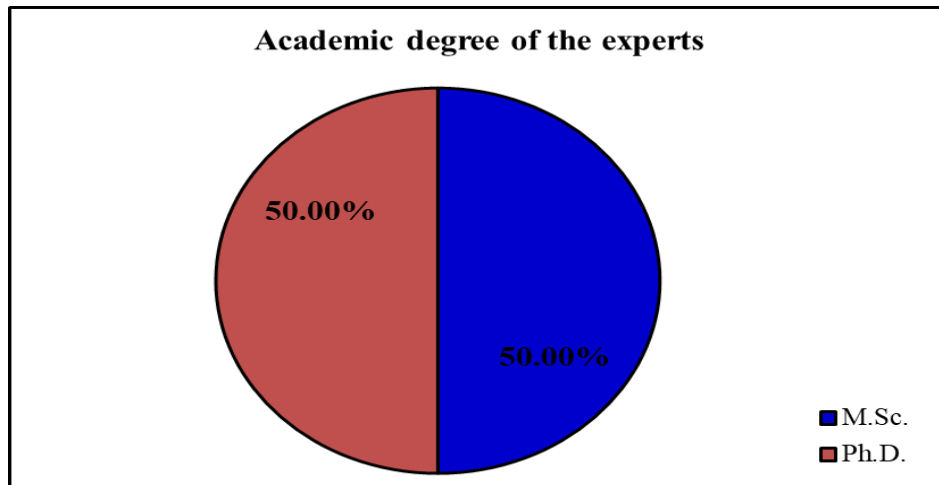


Figure (6): Distribution of academic degrees of experts.

### A.3. Experts proportion of clearance for DEMMI

The expert's proportion of clearance of DEMMI is shown in Table (6). The mean of the clearance proportion (clear responses) was 90.00%. Also, 10% of experts had proportion of clearance 80%, 40% of experts had proportion of clearance 80-90%, and 40% of experts had proportion of clearance more than 90%, while 10% of experts had proportion of clearance 100%.

Table (6): Experts proportion of clearance for DEMMI

Expert number	Number of agreements (clear responses)	Expert proportion of Clearance
1	13	86.7
2	15	100
3	13	86.7
4	14	93.3
5	13	86.7
6	14	93.3
7	14	93.3
8	14	93.3
9	13	86.7
10	12	80.0
Mean	13.5	90.00

## B. Experts results for content validity (Panel II)

### B.1. Descriptive statistics for general characteristics of the experts

The mean values of experts' experience years are shown in (Table 7 and figure 7). Ten expert physiotherapists whose specialty is rehabilitation of general surgery to test the content validity of the new Arabic version of DEMMI questionnaire. The experience Mean  $\pm$ SD value of 10 expert physiotherapists was  $14.90 \pm 6.50$  years with minimum value 7.00 years and maximum value 19.00 years of experience.

Table (7): Mean, standard deviation, minimum, and maximum values of experts' experience years

Experts	Years of experience
Number	10.00
Mean $\pm$ SD	$14.90 \pm 6.50$
Minimum	7.00
Maximum	19.00

Data are expressed as mean  $\pm$ standard deviation (SD)

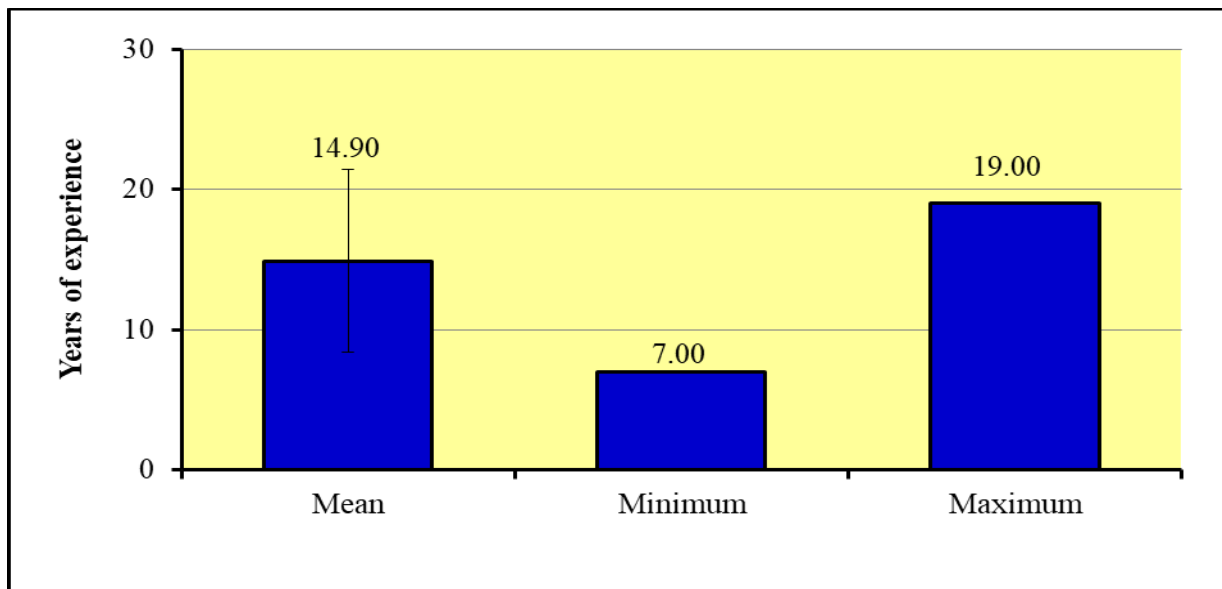


Figure (7): Mean, minimum, and maximum values of experts' experience years.

The distribution of 10 experts' academic degree involved in this study to test the face and content validity of DEMMI Arabic version (Table 8 and Figure 8) revealed the number (percentage) of academic degree were 3 M.Sc. (30.00%) and 7 Ph.D. (70.00%).

Table (8): Distribution of experts' academic degrees.

Items	Academic degree		Total
	M.Sc.	Ph.D.	
Frequency	3	7	10
Percentage	30.00%	70.00%	100%

Data are expressed as frequency and percentage

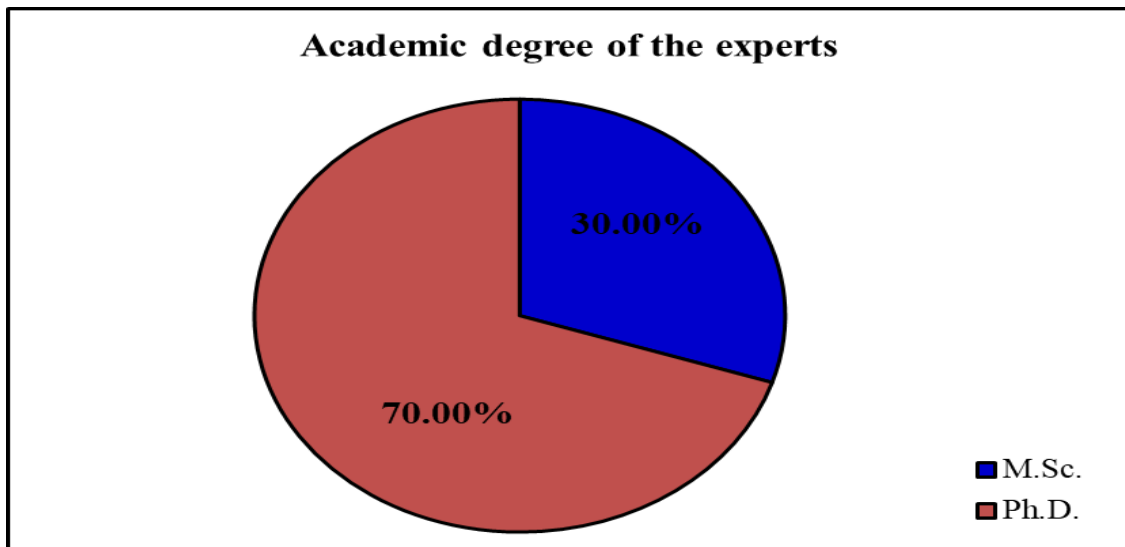


Figure (8): Distribution of academic degree in the experts.

### B.2. Content validity index statistics of DEMMI (CVI):

The expert opinions according to content validity index (CVI) or index of relevance for the DEMMI questionnaire are presented in Table (9). According to the expert opinions, all items were relevant with mean S-CVI = 98.00% for all 15 items. Twelve items were relevant, with CVI = 100%. The items (1), (8), and (10) had CVI = 90.00% and the universal agreement (UA) was 0.8.

Table (9): Expert opinions according to content validity index (CVI) of DEMM.

Number	Very relevant	Relevant but needs minor alteration	Unable to assess relevance	Not relevant	I-CVI	%CVI	UA
Item 1	9	1	0	0	0.9	90%	0
Item 2	10	0	0	0	1	100%	1
Item 3	10	0	0	0	1	100%	1
Item 4	10	0	0	0	1	100%	1
Item 5	10	0	0	0	1	100%	1
Item 6	10	0	0	0	1	100%	1
Item 7	10	0	0	0	1	100%	1
Item 8	9	1	0	0	0.9	90%	0
Item 9	10	0	0	0	1	100%	1
Item 10	9	1	0	0	0.9	90%	0
Item 11	10	0	0	0	1	100%	1
Item 12	10	0	0	0	1	100%	1
Item 13	10	0	0	0	1	100%	1
Item 14	10	0	0	0	1	100%	1
Item 15	10	0	0	0	1	100%	1
Mean CVI for all items ( S – CVI)					0.98	98.00%	0.8

### B.3. Experts proportion of relevance for DEMMI Arabic final version:

The expert's proportion of relevance for DEMMI Arabic final version is illustrated in Table (10). The mean of the relevance proportion (relevant responses) was 98%. Twelve experts recorded proportion of relevance at 100%. But, the items (1), (4), (5) recorded the relevance proportion = 93.33%.

Table (10): Experts proportion of relevance for DEMMI Arabic final version

Expert number	Number of agreement (relevant responses)	Proportion of relevant
1	14	93.33%
2	15	100%
3	15	100%
4	14	93.33%
5	14	93.33%
6	15	100%
7	15	100%
8	15	100%
9	15	100%
10	15	100%
Mean	14.70	98.00%

### C. Feasibility measures of DEMMI items:

The index demonstrated high feasibility, with an average completion time of  $9.00 \pm 2.47$  minutes. The observed range was 6 to 15 minutes, indicating a manageable time burden for participants. Importantly, no missing data was observed for any items. A detailed breakdown of the time taken to complete the scale, including frequencies and percentages, is presented in Table (11) and figure(9).

Table (11): Descriptive statistics of time of 103 sheets in whole study population group.

Study group (n=103)	Time in minutes
Mean $\pm$ SD	9.00 $\pm$ 2.47
Median	8.98
Minimum	6.00
Maximum	15.00

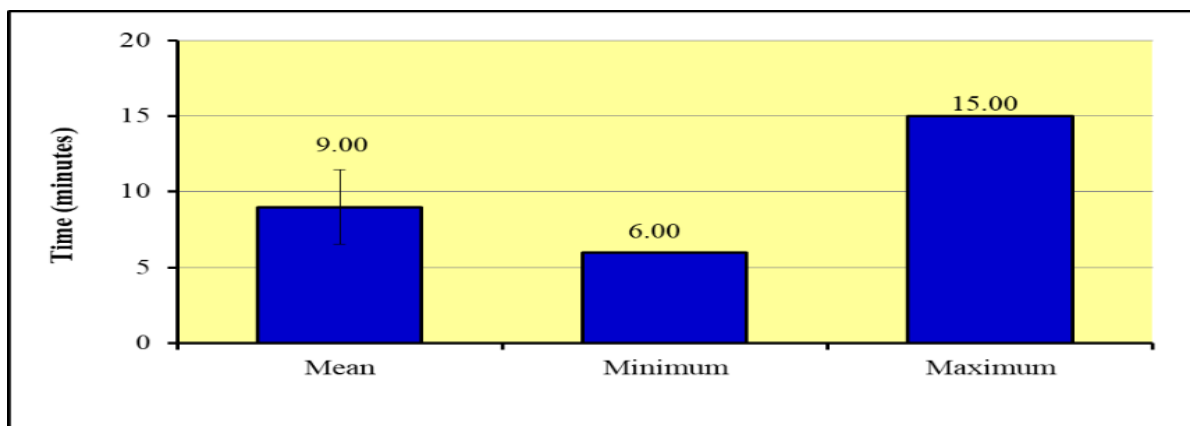


Figure (9): Mean, minimum, and maximum values of time taken (minutes) to complete the DEMMI items.

The frequency distribution of time needed to fill in the questionnaire in minutes is presented in Table (12). The descriptive statistics of time were taken to answer the questions of patient part of the DEMMI in minutes showed that 7 sheets took 6 minutes, 9 sheets took 7 minutes, 10 sheets took 8 minutes, 12 sheets took 9 minutes, 17 sheets took 10 minutes, 18 sheets took 11 minutes, 11 sheets took 12 minutes, 8 sheets took 13 minutes, 5 sheets took 14 minutes and 6 sheet took 15 minutes. As noted, there is 94% of all sheets take 14 minutes or less to be filled, which is considered a very good time.

Table (12): Frequency distribution of time needed to fill in the DEMMI items in minutes

Time in (minute)	Frequency (n=103)	Percentage	Cumulative percentage
6	7	6.80%	6.80%
7	9	8.74%	15.53%
8	10	9.71%	25.24%
9	12	11.65%	36.89%
10	17	16.50%	53.40%
11	18	17.48%	70.87%
12	11	10.68%	81.55%
13	8	7.77%	89.32%
14	5	4.85%	94.17%
15	6	5.83%	100.00%
Mean $\pm$ SD	10.30 $\pm$ 4.16	100.00%	

**Reliability analysis:**

Reliability reflects how consistently a method assesses something. When the same result is regularly obtained using the same procedures under the same conditions, the measurement is called reliable.[18]

**1-Internal consistency reliability of DEMMI for laparoscopic and laparotomy patients**

The internal consistency or reliability across a survey item set is quantified through Cronbach's alpha coefficient. This statistical measure helps determine whether multiple items collectively assess the same characteristic with consistency. This coefficient, ranging from 0 to 1, indicates stronger item agreement as values approach 1.

The reliability of the questionnaire was assessed by using Cronbach's alpha for each item of scale, as well as the value for the overall axis of DEMMI questionnaire. An adequate  $\alpha$  level of internal consistency was detected at  $\alpha \geq 0.7$ , where excellent ( $\alpha \geq 0.9$ ), good ( $0.9 > \alpha \geq 0.8$ ), acceptable ( $0.8 > \alpha \geq 0.7$ ), questionable ( $0.7 > \alpha \geq 0.6$ ), poor ( $0.6 > \alpha \geq 0.5$ ), and unacceptable ( $\alpha < 0.5$ ). The Overall Cronbach's alpha  $\geq 0.70$ , it's minimally acceptable by most standards.[19]

The reliability analysis (internal consistency are of DEMMI for laparoscopic and laparotomy patients after abdominal surgeries for each item and overall is presented in Table (13). The results of statistical analysis by Cronbach's alpha indicated that the overall internal consistency of observer scale of the DEMMI was high level with Cronbach's alpha = 0.903. Cronbach's alpha confirms a very high level of internal consistency (excellent;  $\alpha \geq 0.9$ ) of the DEMMI questionnaire. Therefore, the DEMMI items satisfied the reliability criteria at retest for laparoscopic and laparotomy patients after abdominal surgeries.

Table (13): Internal consistency reliability of DEMMI for laparoscopic and laparotomy patients.

DEMMI items	Cronbach's Alpha value	
	Cronbach's alpha if item deleted	Cronbach's alpha of scale as total
Item 1	0.889	0.903
Item 2	0.922	
Item 3	0.939	
Item 4	0.916	
Item 5	0.856	
Item 6	0.957	
Item 7	0.959	
Item 8	0.939	
Item 9	0.915	
Item 10	0.880	
Item 11	0.966	
Item 12	0.950	
Item 13	0.934	
Item 14	0.776	
Item 15	0.743	

## 2-Content validity of the final version of Arabic DEMMI:

Referring to the degree that the instrument covers the contents that it is designed to measure. [20] Inter-class correlation coefficients (ICC) of the DEMMI for laparoscopic and laparotomy patients.

The intra-class correlation coefficient (ICC) assesses rating reliability (Test-retest reliability) in multi-rater studies. This coefficient spans from 0 (indicating complete unreliability) to 1 (representing perfect reliability). Poor reliability (ICC less than 0.50), moderate reliability (ICC from 0.50 to 0.75), good reliability (ICC from 0.75 to 0.90), and excellent reliability (ICC greater than 0.90).[21]

Intra-rater reliability for each item of DEMMI index in laparoscopic and laparotomy patients is presented in Table (14) and Figure (10). In the current DEMMI questionnaire, the ICC value for all items of DEMMI questionnaire ranged from 0.800 to 0.978 with the ICC value for total score more than 0.90 (ICC = 0.968) by the same tester (intra-rater reliability). This indicated acceptable DEMMI questionnaire items and excellent reliability ( $P=0.0001$ ) for laparoscopic and laparotomy patients.

Table (14): Intra-rater reliability of DEMMI items for laparoscopic and laparotomy patients

Questions	DEMMI score		ICC	95% CI	P-value	Significance
	Test	Retest				
Item 1	0.72 ±0.05	0.70 ±0.06	0.867	0.804 – 0.910	0.0001*	S
Item 2	0.78 ±0.41	0.76 ±0.43	0.912	0.870 – 0.940	0.0001*	S
Item 3	1.30 ±0.69	1.30 ±0.71	0.914	0.873 – 0.942	0.0001*	S
Item 4	0.82 ±0.39	0.79 ±0.41	0.952	0.928 – 0.967	0.0001*	S
Item 5	1.24 ±0.67	1.33 ±0.67	0.918	0.978 – 0.944	0.0001*	S
Item 6	0.64 ±0.18	0.61 ±0.20	0.969	0.954 – 0.979	0.0001*	S
Item 7	0.75 ±0.14	0.78 ±0.11	0.930	0.896 – 0.952	0.0001*	S
Item 8	0.79 ±0.12	0.76 ±0.13	0.860	0.793 – 0.905	0.0001*	S
Item 9	0.67 ±0.47	0.67 ±0.47	0.978	0.967 – 0.985	0.0001*	S
Item 10	0.63 ±0.14	0.66 ±0.17	0.968	0.953 – 0.978	0.0001*	S
Item 11	1.07 ±0.46	1.09 ±0.43	0.906	0.861 – 0.936	0.0001*	S
Item 12	0.98 ±0.27	1.03 ±0.48	0.924	0.888 – 0.949	0.0001*	S
Item 13	0.59 ±0.19	0.62 ±0.18	0.883	0.827 – 0.921	0.0001*	S
Item 14	0.70 ±0.16	0.74 ±0.14	0.849	0.776 – 0.898	0.0001*	S
Item 15	0.50 ±0.12	0.55 ±0.15	0.800	0.705 – 0.865	0.0001*	S
Total score	49.51 ±7.23	50.48 ±7.54	0.968	0.953 – 0.979	0.0001*	S

Data are expressed as mean ±standard deviation (SD); 95%CI: 95% confidence interval P-value: probability value; \*significant:  $P<0.05$

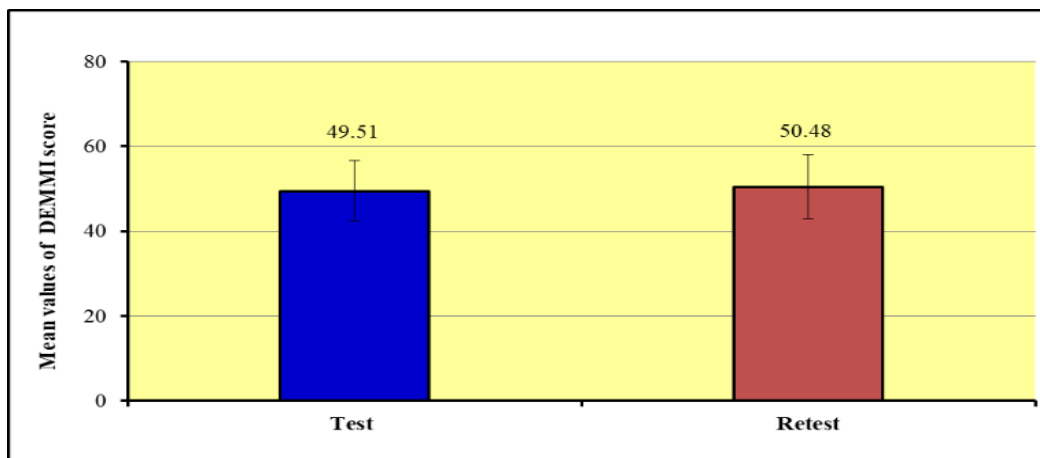


Figure (10): Mean values of DEMMI score for laparoscopic and laparotomy patients in test and retest for intra-rater reliability.

**Floor and ceiling effect:**

The response distribution of prevalence of floor and ceiling effect in DEMMI items is presented in Table (15) and Figures (11). At test almost all of patients scored 1 (moderate score), followed by 0 (lowest score), and then scored 2 (highest score). The response distribution showed that there was no ceiling effect as there were only (6.67%) of participants scored (2). In the other hand, there was floor effect as about ( 37.78%) of participants scored (0).

Table 15: The response distribution of prevalence of DEMMI .

DEMMI	Items	Laparoscopic and laparotomy patients
Test	(0)	17 (37.78%)
	(1)	33 (73.33%)
	(2)	3 (6.67%)

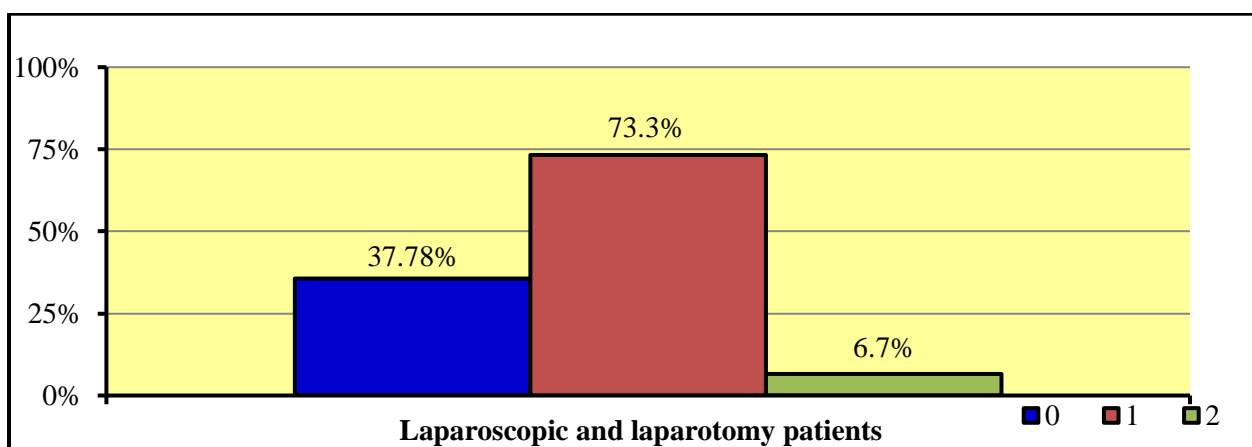


Figure 11: Distribution of floor and ceiling effect in DEMMI items.

**4. Discussion**

The present study was designed to evaluate the Arabic version of the DEMMI for post-abdominal surgery patients across multiple validation dimensions: face validity, content validity, feasibility, internal consistency reliability, and test-retest reliability. The research involved two expert panels (ten specialists per panel) and 103 patients. The study was implemented at Mansoura International Hospital in Egypt.

**1-Validity of the Arabic version of the DEMMI:**

The Arabic version of the De Morton Mobility Index scale had an exceptional mean index of clarity of 96.76%, the Arabic version of the DEMMI scale has excellent face validity. The Arabic version of the DEMMI scale has a clarity value that varies from 80% to 100%. The average expert proportion of clearance was 90%, which is excellent. With a scale CVI (S-CVI) of 0.98 and a universal agreement (UA) of 0.8, the expert proportion of clearance ranged from 90% to 100% and possesses excellent content validity. 98% is an excellent mean expert proportion of relevance. Three experts scored a 93.33 % relevance percentage, while seven experts had a 100% relevance percentage. The current study's findings supported Polit and Beck's results that a scale with Excellent content validity would consist of items with item indexes of content validity (I-CVI) that satisfy the following requirements: a minimum I-CVI of 0.78 for six to ten experts, and an I-CVI of 1.00 for three to five experts. A scale with great content validity, according to researchers, should have S-CVI/UA of 0.8 or higher and I-CVIs of 0.78 or higher.[22]

**2-Feasibility of the Arabic version of the DEMMI:**

The Arabic version of the De Morton Mobility Index has high feasibility because the scale items were done with all patients, and it needed an average of  $9.00 \pm 2.47$  minutes to be completed with a maximum of 15 min and a minimum of 6 min. It took 9 minutes or less to be completed in about 36.89% of all patients, less than 15 minutes in about 94.17% of all patients and 15 minutes in about 5.83% of all patients. There were no missing items. The De Morton Mobility Index is easy and quick to administer, can be conducted in a relatively small area, has minimal equipment requirements, and required average

time of  $9.00 \pm 2.47$  minutes to be completed.[8]

### 3- Internal consistency and test-retest reliability of the Arabic version of the DEMMI:

The overall Cronbach's alpha for The Arabic version of DEMMI has excellent internal consistency and excellent test-retest reliability, as Cronbach's alpha equaled 0.903. The Cronbach alpha  $\geq 0.9$  (excellent) internal consistency. [23]

The Arabic version of DEMMI displayed robust test–retest reliability in all items; ICC of 0.968 (95% CI: 0.953–0.979), demonstrating stable scores across repeated administrations. These findings suggest that the DEMMI index demonstrates high internal consistency across all patient groups, with excellent reliability observed post-abdominal surgeries. This reflects that the items within the DEMMI index consistently measure the same underlying construct across all patient groups. The correlation between the two separate measurements is most accurately assessed using the ICC when it is above 0.80 is considered to be excellent. [24]

These results are compatible with the Brazilian and Dutch versions as ICC values equal 0.92 for Brazilian version with CI 95% (0.88-0.94) and ICC values equal 0.94 for Dutch version with CI 95% (0.86-0.98). [3]

Both floor and ceiling effects were identified when 15% or more of participants achieved either the minimum or maximum scale scores, respectively. [25]

The study revealed a negligible ceiling effect (6.67%) and a substantial floor effect (37.78%) for the index overall. This finding is consistent with the Danish version of the scale, which also reported a significant floor effect (39%). [3] A plausible explanation is that our sample consisted of individuals whose mobility was assessed after surgery, with a retest after 24 hours of the first test.

This study constitutes a crucial step in the validation and reliability assessment of the Arabic-language version of the DEMMI specifically within an Egyptian patient population. The finalized version of this Arabic translation will serve as the foundation for subsequent research aimed at comprehensively establishing the psychometric properties of the DEMMI in this context.

### 5. Conclusion:

The findings of this study validate the Arabic version of the DEMMI as a robust, reliable, and user-friendly tool for assessing mobility impairments in postoperative patients. Its exceptional face and content validity, combined with high internal consistency and test-retest reliability, make it a practical and effective instrument for clinical and research purposes. The tool's high feasibility, reflected in its short completion time, further enhances its utility in diverse healthcare settings. The results suggest that the Arabic DEMMI can have a significant role in improving mobility assessments and rehabilitation outcomes in Arabic-speaking populations. Future research should extend its validation to broader and more varied patient groups to confirm these findings and explore its application in other clinical contexts.

**Conflict of interest:** The authors declare no conflict of interest.

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