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# Perception of faculty in the community health sciences colleges towards simulation-based education in clinical nutrition undergraduate practical courses

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## Abstract

**Background**  Simulation now is widely used for training and education in different fields including healthcare education. Medicine and healthcare students can be trained in a secure, efficient, and engaging setting by Simulation-based Education (SBE). Therefore, this study aimed to assess the perception of faculty members in the community health departments towards SBE to be used in practical subjects for clinical nutrition undergraduate courses.

**Method**  This cross-sectional survey was conducted among community health sciences faculty members. The perception was assessed using a self-administered questionnaire that included three sections.

**Results**  This questionnaire was completed by 125 faculty members, of whom 36 (28.8%) were male and 89 (71.2%) were female. Overall, faculty members had positive perceptions, with a mean score of $3.86 \pm 0.74$, but a high level of anxiety toward SBE, with a mean score of $3.42 \pm 0.75$. There was a statistically significant difference between the responses of the faculty members based on the training they received in simulation ($P = 0.001$).

**Conclusion**  The study results indicate that community health sciences faculty members' perception of SBE in Saudi Arabia is generally positive. However, the results show high levels of anxiety among faculty members toward SBE.

**Keywords**  Simulation, Simulation-based education, Undergraduate, Nutrition, Dietetics, Faculty, Faculty members

## Background

Medicine and healthcare students can be trained in a secure, efficient, and engaging setting thanks to Simulation-based Education (SBE) [1]. A training or educational technique known as SBE uses guided experiences to supplement or replace real-world experience [2]. It is defined as an educational strategy based on learning theories rather than technology [1]. Simulation aims to interactively recreate elements of the real world so that learners can fully immerse themselves in the learning environment [2, 3]. Simulators have long been used in aviation and the military to train employees in technical skills and safety-related attitudes (such as teamwork and communication) [4]. There are various simulation techniques available [5]. The most prevalent techniques are role-playing, standardized or simulated patients, computerized mannequins, and virtual simulations [5]. SBE has been the subject of extensive study and research for over

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two decades [5]. A significant portion of the undergraduate curriculum now includes simulation in the healthcare sciences as an evidence-based, efficient learning tool [5].

Simulation in medical healthcare practice and education has been applied since the early twentieth century [6, 7]. Unlike simulation in medicine, nursing, and other healthcare sectors, simulation in nutrition and dietetics began to see the light in the late 70s [8]. Most of the research was conducted in the United States. In 1979, The University of Connecticut used simulation exercises for interview training in dietetics to develop counseling and interviewing skills for the students [8]. In the same year, Syracuse University applied a course in the first semester of the junior year, which involved a simulated team conference for nursing and dietetics students to educate them about the healthcare team [9]. In 1981, at The University of Pennsylvania, the students watched videotaped simulated interviews to learn counseling and communication skills in the nutrition course [10]. In the mid-80s, The University of Pittsburgh used simulation interviews to evaluate students` clinical skills for nutrition counseling [11]. This evaluation aimed to assess graduate students` clinical skills to resolve issues with dietary adherence [11]. During the same period, The University of Kentucky developed a learning technique for senior dietetics students to prepare them for the future [12]. This learning activity included scenarios and simulation games where the students selected a career choice and discussed the options created by the scenarios [12]. In the late 80s, The University of Nebraska provided a nutrition workshop for 30 managers of government-sponsored nutrition centers for the elderly in different areas of the country [13]. The workshop involved videotaped simulations of typical nutritional issues experienced by older adults in these centers [13]. As an outcome, the knowledge increased, and 75% of the managers benefited and applied the ideas from the workshop [13]. In the 1990s, the research surrounding simulation in nutrition and dietetics began to appear and continued to increase until today [14]. Furthermore, the interest and demand for simulation in medical education have increased due to its advantages, including providing safe and effective patient care, reducing medical errors, experiential learning, deliberate practice, transformative learning, and debriefing techniques [15]. Despite that, simulation application in nutrition and dietetics is underexplored compared with other medical fields where simulation has been practiced for decades [14].

A systematic review published in 2019 and included fourteen studies about simulation in dietetics demonstrated that using simulated patients was essential for building and developing counseling skills and readiness for practice [16]. Moreover, simulated patients could be used to assess counseling skills in Objective Structured Clinical Examination (OSCE) exams [16]. Since the decision-making in dietetics depends on evidence-based practice, the development and application of evaluation methods are needed to support the evidence base for simulation skill acquisition in dietetics education [16]. Eventually, further research about simulation in dietetics and nutrition is needed to determine the skills likely to be developed and enhanced by simulation [16].

There are only a few studies in the last five years that were published about the use of simulation in nutrition and dietetics training or education worldwide [17–25]. As is the case worldwide, to the best of our knowledge, only a few studies were done in Saudi Arabia about the perception towards simulation in education, either among faculty members or students in health colleges [1, 26]. Consequently, as far as we know, this is the first study in Saudi Arabia that assessed faculty perception towards SBE in the community health sciences departments. It is suggested that the use of simulation in education will improve students` self-esteem, skills, critical thinking, teamwork, essential procedural skills, and decision-making, likewise increasing patients` safety and reducing medical errors [15]. Based on the MedTeams study, simulation practice decreased medical errors by 26.5% [27]. Moreover, most studies about simulation and nutrition published in the last ten years were conducted among students, athletes, and the general population. Thus, this study aimed to assess faculty members` perception in the community health departments towards SBE to be used in practical subjects for clinical nutrition undergraduate courses, to identify faculty members' perceived barriers toward the integration of SBE, and to fill the gap regarding SBE in nutrition.

## Methods
### Study setting
This is a cross-sectional survey in which Saudi universities that provided a Clinical Nutrition program in Saudi Arabia were targeted during the last semester of the academic year 2022–2023. The study surveyed faculty members from the Colleges of Applied Medical Sciences (CAMS) in 16 universities. Universities that are included in this study are King Saud University, King Saud bin Abdulaziz University for Health Sciences, Princess Nourah bint Abdulrahman University, Umm Al-Qura University, King Abdulaziz University, King Faisal University, Qassim University, Taibah University, University of Hail, Jazan University, Al Baha University, Northern Borders University, Imam Abdulrahman Bin Faisal University, University of Hafr al Batin, University of Tabuk, and Shaqra University.

Faculty were invited via university email to fill out a self-administered questionnaire. Social media platforms such as LinkedIn, WhatsApp, and Twitter were used to

distribute the questionnaire among faculty using a snowball sampling technique. The study will identify the universities by pseudonym, as well as, the anonymity of the participants to ensure confidentiality.

### Subjects

In this cross-sectional survey, faculty members from different universities in Saudi Arabia were approached. Faculty members from both genders who have taught clinical nutrition practical subjects and who have had at least two years of experience in their academic work were included. Faculty members who had never taught clinical nutrition practical subjects were excluded. Furthermore, the exclusion criteria included newly employed faculty members.

G*Power 3 [28] was used to determine the sample size that will allow for the assessment of meaningful associations and the detection of effect sizes (small, medium, or large). Using the one-way ANOVA test and an alpha value of 0.05, the results indicated that with a power of 0.95, sample sizes of 1865, 305, and 125 were needed to detect effect sizes of 0.10 (small), 0.25 (medium), and 0.40 (large), respectively. Reaching the study's sample size of 125 meant that large effect sizes could be detected in the statistical analyses.

### Data collection

The questionnaire used for this study was developed by Ahmed et al. [26], which was inspired by literature [2, 28–30] and resulted from discussions with medical teachers. The questionnaire was subjected to a pilot sample of 35 faculty members before being distributed in its final form. The data was initially treated to verify the psychometric characteristics of the questionnaire, so the reliability coefficient of Cronbach's alpha was extracted for the questionnaire dimensions separately. Then, the overall reliability of the questionnaire was calculated. The reliability coefficient of Cronbach's alpha showed that the questionnaire has good reliability coefficients ranging from the value (0.86) to (0.90), that have located in the range of excellent reliability coefficients (0.80–1) identified by [32], which makes it valid to achieve the objectives of the study. In general, the result showed that the reliability of the overall questionnaire is (0.88), which means that it is possible to obtain identical results by (88%) between this application and re-application of this questionnaire, and this implicitly means that the items are clear and explicit and carry accurate ideas for which the respondent's understanding of it does not vary with time. Pearson correlation coefficients were calculated to examine the correlation of the questionnaire's items with the dimensions to which they belong to ensure the structural validity of the questionnaire. The result showed that the correlation coefficients of the items with their

affiliated dimensions are significant correlations at the level of significance (0.01), which indicates a high internal validity of the dimensions of the questionnaire. The items associated with the total average of the responses of the dimensions are considered valid expressions that measure what they were set for.

The questionnaire, in its final form, consisted of [27] items, which were divided into four main dimensions: 1st faculty members' perceptions toward simulation-based education, 2nd determine anxiety of faculty members toward simulation-based education, 3rd faculty members' perception toward the integration of simulation in education, and 4th faculty members' perceived barriers to simulation-based education in undergraduate curricula.

At the beginning of the questionnaire form, a brief paragraph about the study and the study's aim helped introduce the respondents to the study. To obtain consent, the respondents agreed to participate by clicking a button for participation agreement before answering the questionnaire. The survey was distributed in English, and it involved three parts. The first part included socio-demographic data of respondents such as gender, age, education, occupation, level of experience, teaching university, formal training for SBE, and exposure to SBE during teachers' clinical nutrition education. The second part included some questions to assess teachers' perceptions of SBE and integrate it into their teaching. Answers from the respondents were read on a five-point Likert-type scale. In the last part, an open-ended question was asked to explore faculty members' perceived barriers toward SBE. Faculty were invited via university email to fill out a self-administered questionnaire. Social media platforms such as LinkedIn, WhatsApp, and Twitter were used to distribute the questionnaire among faculty using a snowball sampling technique. The study will identify the universities by pseudonym, as well as the anonymity of the participants to ensure confidentiality.

### Statistical analysis

After the data collection, data were organized, checked, and analyzed with the Statistical Package for the Social Sciences (SPSS) version 25. Frequencies and percentages expressed the number of participants in the socio-demographic variables. Descriptive statistics, t-test, one-way ANOVA, chi-square test, means, and standard deviation were used for data analysis. A P-value < 0.05 will be considered to be statistically significant.

### Likert's scale intervals

The length of the intervals in the five-point Likert scale was determined by calculating the range $(5-1=4)$ and then dividing it by the most significant value in the scale to get the length of the interval $(4 \div 5 = 0.8)$, then this value was added to the lowest value in the scale (the

**Table 1** Likert's scale intervals

| Verbal scale | Strong-ly Agree | Agree | Neutral | Disagree | Strong-ly dis-agree |
|---|---|---|---|---|---|
| Percep-tion degree | Very positive | Positive | Moderate | Negative | Very negative |
| Anxiety degree | Very high | High | Moderate | Low | Very low |
| Numeric scale | 5 | 4 | 3 | 2 | 1 |
| Scale intervals | More than 4.20 | From 3.40 to less than 4.20 | From 2.60 to less than 3.40 | From 1.80 to less than 2.60 | Less than 1.80 |

beginning of the scale, which is an integer one), to determine the upper limit of this interval. Table 1. shows Likert's scale intervals.

## Results

### Socio-demographic data of the sample

A total of 125 faculty members filled out the questionnaire. Table 2. shows the distribution of the participants according to the study variables. The majority were females (71.2%), and (93.6%) aged less than 60 years. Most participants held either a Master's degree (45.6%) or followed by Doctorate (43.2%) and none of the respondents had postgraduate diplomas. Most of the participants had more than five years of experience. 68% of participants did not receive formal simulation training ($P=0.001$), and 62.4% were not exposed to SBE during their education.

As shown in Table 3. there was a statistically significant difference in age between received training for simulation or not ($P=0.016$); 62.5% of those who received formal training for simulation were aged 40–59 years, whereas 57.6% of those who did not were 20–39 years. As well as for training for simulation and educational level ($P=0.012$), 50.6% of those who did not receive formal training for simulation were with a Doctorate, and 65% of those who received formal training for simulation were with a Master's degree. Furthermore, a statistically significant difference between received training for simulation and occupation was observed ($P=0.015$). Associate Professors and Professors were the occupations that received the most formal training for simulation (50%).

As shown in Table 4. there was a statistically significant difference between the exposure to simulation during education and educational level (P=<0.001), ); 68.1% of participants with a Master's degree were exposed to simulation during schooling. No differences were observed between the exposure to simulation during education and other socio-demographic variables.

**Table 2** Study sample socio-demographic data (*N*=125)

| Variable | N (%) | Total N (%) | Mean score (SD) | *p*-Val-ue |
|---|---|---|---|---|
| **Gender** | | | | |
| Male | 36 (28.8%) | 125 | 3.54 (0.57) | 0.244 |
| Female | 89 (71.2%) | (100%) | 3.67 (0.55) | |
| **Age** | | | | |
| 20–39 | 62 (49.6%) | 125 | 3.53 (0.57) | 0.117 |
| 40–59 | 55 (44%) | (100%) | 3.73 (0.56) | |
| +60 | 8 (6.4%) | | 3.72 (0.29) | |
| **Education** | | | | |
| Postgraduate certificates | 14 (11.2%) | 125 | 3.65 (0.54) | 0.916 |
| Postgraduate diplomas | - | (100%) | - | |
| Master's degrees | 57 (45.6%) | | 3.65 (0.50) | |
| Doctorates | 54 (43.2%) | | 3.61 (0.62) | |
| **Occupation** | | | | |
| Teaching Assistant | 15 (12%) | 125 | 3.55 (0.45) | 0.822 |
| Lecturer | 32 (25.6%) | (100%) | 3.60 (0.60) | |
| Assistant Professor | 38 (30.4%) | | 3.67 (0.62) | |
| Associate Professor | 25 (20%) | | 3.72 (0.43) | |
| Professor | 15 (12%) | | 3.54 (0.60) | |
| **Level of experience** | | | | |
| Less than 5 years | 51 (40.8%) | 125 | 3.65 (0.57) | 0.915 |
| 6–10 years | 41 (32.8%) | (100%) | 3.60 (0.50) | |
| More than 11 years | 33 (26.4%) | | 3.64 (0.61) | |
| **Teaching university** | | | | |
| A | 6 (4.8%) | 125 | 3.43 (0.48) | 0.957 |
| B | 6 (4.8%) | (100%) | 3.74 (0.89) | |
| C | 14 (11.2%) | | 3.64 (0.56) | |
| D | 9 (7.2%) | | 3.81 (0.60) | |
| E | 7 (5.6%) | | 3.63 (0.59) | |
| F | 9 (7.2%) | | 3.68 (0.67) | |
| G | 15 (12%) | | 3.56 (0.55) | |
| H | 5 (4%) | | 3.38 (0.69) | |
| I | 9 (7.2%) | | 3.68 (0.65) | |
| J | 5 (4%) | | 3.44 (0.58) | |
| K | 6 (4.8%) | | 3.93 (0.31) | |
| L | 8 (6.4%) | | 3.62 (0.30) | |
| M | 6 (4.8%) | | 3.71 (0.55) | |
| N | 9 (7.2%) | | 3.46 (0.65) | |
| O | 4 (3.2%) | | 3.53 (0.42) | |
| P | 7 (5.6%) | | 3.78 (0.39) | |
| **Received training for simulation** | | | | |
| Yes | 40 (32%) | 125 | 3.89 (0.45) | 0.001* |
| No | 85 (68%) | (100%) | 3.51 (0.56) | |
| **Exposed to SBE during education** | | | | |
| Yes | 47 (37.6%) | 125 | 3.71 (0.55) | 0.201 |
| No | 78 (62.4%) | (100%) | 3.58 (0.56) | |

* Significant difference at the level (0.05) or less for t-test and one-way ANOVA. (SD): Standard Deviation

### Faculty members' perceptions toward simulation-based education

Table 5 demonstrates faculty members` perceptions toward SBE in percentages and numbers, which will be

**Table 3** Received training for simulation and socio-demographic data

| Variable | Received training for simulation | | p-Value |
|---|---|---|---|
| | Yes N (%) | No N (%) | |
| **Gender** | | | 0.099 |
| Male | 8 (20.0%) | 28 (32.9%) | |
| Female | 32 (80.0%) | 57 (67.1%) | |
| **Age** | | | *0.016 |
| 20–39 | 13 (32.5%) | 49 (57.6%) | |
| 40–59 | 25 (62.5%) | 30 (35.3%) | |
| +60 | 2 (5%) | 6 (7.1%) | |
| **Education** | | | *0.012 |
| Postgraduate certificates | 3 (7.5%) | 11 (12.9%) | |
| Master's degrees | 26 (65%) | 31 (36.5%) | |
| Doctorates | 11 (27.5%) | 43 (50.6%) | |
| **Occupation** | | | *0.015 |
| Teaching Assistant | 3 (7.5%) | 12 (14.1%) | |
| Lecturer | 9 (22.5%) | 23 (27.1%) | |
| Assistant Professor | 8 (20%) | 30 (35.3%) | |
| Associate Professor | 10 (25%) | 15 (17.6%) | |
| Professor | 10 (25%) | 5 (5.9%) | |
| **Years of experience** | | | 0.659 |
| Less than 5 years | 17 (42.5%) | 34 (40%) | |
| 6–10 years | 11 (27.5%) | 30 (35.3%) | |
| More than 11 years | 12 (30%) | 21 (24.7%) | |

*Note* The qualitative variables were compared using the chi-square cross-tabulation test and presented as n (percentage). *A *P* value<0.05 is considered significant

**Table 4** Exposure to SBE during education and socio-demographic data

| Variable | Exposure to simulation | | p-Value |
|---|---|---|---|
| | Yes N (%) | No N (%) | |
| **Gender** | | | 0.204 |
| Male | 11 (23.4%) | 25 (32.1%) | |
| Female | 36 (76.6%) | 53 (67.9%) | |
| **Age** | | | 0.210 |
| 20–39 | 22 (46.8%) | 40 (51.3%) | |
| 40–59 | 24 (51.1%) | 31 (39.7%) | |
| +60 | 1 (2.1%) | 7 (9%) | |
| **Education** | | | *< 0.001 |
| Postgraduate certificates | 2 (4.3%) | 12 (15.4%) | |
| Master's degrees | 32 (68.1%) | 25 (32.1%) | |
| Doctorates | 13 (27.7%) | 41 (52.6%) | |
| **Occupation** | | | 0.078 |
| Teaching Assistant | 4 (8.5%) | 11 (14.1%) | |
| Lecturer | 13 (27.7%) | 19 (24.4%) | |
| Assistant Professor | 10 (21.3%) | 28 (35.9%) | |
| Associate Professor | 10 (21.3%) | 15 (19.2%) | |
| Professor | 10 (21.3%) | 5 (6.4%) | |
| **Years of experience** | | | 0.659 |
| Less than 5 years | 23 (48.9%) | 28 (35.9%) | |
| 6–10 years | 12 (25.5%) | 29 (37.2%) | |
| More than 11 years | 12 (25.5%) | 21 (26.9%) | |

*Note* The qualitative variables were compared using the chi-square cross-tabulation test and presented as n (percentage). *A *P* value<0.05 is considered significant

shown in detail in the following sections with means and standard deviation.

### First dimension: faculty members' perceptions toward simulation-based education

Table 6 shows the arithmetic means and standard deviations of the sample responses sorted in descending order for each item of the first dimension. The general perception toward SBE was positive, with a mean score of 3.86±0.74.

### Second dimension: determine the anxiety of faculty members toward simulation-based education

Table 7 shows the arithmetic means and standard deviations of the sample responses sorted in descending order for each item of the second dimension. The general anxiety toward SBE was high, with a mean score of 3.42±0.75.

### Third dimension: faculty members' perception toward the integration of simulation in education

Table 8 shows the arithmetic means and standard deviations of the sample responses sorted in descending order for each item of the third dimension. The general perception toward the integration of simulation was positive, with a mean score of 3.54±0.79.

### Fourth dimension: faculty members' perceived barriers towards the integration of simulation in education

Faculty members answered an open-ended question regarding perceived barriers they face towards SBE. The most frequent answers were the lack of time, training, facilities, resources, access, simulation labs, or simulation classrooms. The less frequent answers were the lack of cooperation, quick technical support, and motivation.

The answers only mentioned once were: the lack of training on implementation of the tool and the criteria for assessing, the lack of experience as they did not use the simulation at all, the difficulty in applying simulation/challenging to apply, the simulation was not integrated in the curriculum, and cultural barriers. One of the faculty mentioned that 'there is always room for error, no matter how accurate the learning simulation is, there is always some scope for error and doubt when it comes to the re-creation of real-life scenarios, and the biggest drawback of using simulation is maintenance and updates can be costly. Besides these barriers, lack of time, labs, and enough training, particularly during COVID-19, were also mentioned.

Barriers related to the institution/university itself were reported, such as space, university environment, funding, lack of tools/materials, poor facilities, and support.

**Table 5** Faculty members' perceptions toward simulation-based education

| Order | Questions on three dimensions regarding SBE | Strongly agree N (%) | Agree N (%) | Neutral N (%) | Dis-agree N (%) | Strongly disagree N (%) | Total N (%) |
|---|---|---|---|---|---|---|---|
| **Faculty members' perceptions toward simulation-based education:** | | | | | | | |
| 1 | I enjoy my teaching more when I use simulation | 27 (21.6%) | 57 (45.6%) | 32 (25.6%) | 2 (1.6%) | 7 (5.6%) | 125 (100%) |
| 2 | Students show more interest when I use simulation tools | 35 (28%) | 57 (45.6%) | 24 (19.2%) | - | 9 (7.2%) | 125 (100%) |
| 3 | Simulation is an effective assessment tool to evaluate students' learning | 37 (29.6%) | 56 (44.8%) | 23 (18.4%) | - | 9 (7.2%) | 125 (100%) |
| 4 | Simulation-based teaching can improve learning outcomes | 49 (39.2%) | 49 (39.2%) | 14 (11.2%) | - | 13 (10.4%) | 125 (100%) |
| 5 | There is more freedom to learn in a simulated environment than learning in real wards or clinics | 24 (19.2%) | 48 (38.4%) | 35 (28%) | 2 (1.6%) | 16 (12.8%) | 125 (100%) |
| 6 | Standardized patient is the best tool for teaching communication skills | 24 (19.2%) | 62 (49.6%) | 23 (18.4%) | - | 16 (12.8%) | 125 (100%) |
| 7 | Simulation-based education improves patient safety | 30 (24%) | 59 (47.2%) | 24 (19.2%) | - | 12 (9.6%) | 125 (100%) |
| **Determine anxiety of faculty members toward simulation-based education:** | | | | | | | |
| 8 | I need extra support to function effectively in simulation-based teaching | 28 (22.4%) | 60 (48%) | 26 (20.8%) | - | 11 (8.8%) | 125 (100%) |
| 9 | I face problems in managing students in simulated teaching | 9 (7.2%) | 28 (22.4%) | 66 (52.8%) | 1 (0.8%) | 21 (16.8%) | 125 (100%) |
| 10 | It takes more time to plan teaching with simulation tools rather than with real patients in student learning | 17 (13.6%) | 52 (41.6%) | 36 (28.8%) | 1 (0.8%) | 19 (15.2%) | 125 (100%) |
| 11 | I avoid the integration of simulation in my courses | 14 (11.2%) | 20 (16%) | 49 (39.2%) | 7 (5.6%) | 35 (28%) | 125 (100%) |
| 12 | Interaction with standardized patients makes students communicate in an artificial manner with real patients | 18 (14.4%) | 56 (44.8%) | 33 (26.4%) | 2 (1.6%) | 16 (12.8%) | 125 (100%) |
| **Faculty members' perception toward the integration of simulation in education:** | | | | | | | |
| 13 | Simulation should be a part of the medical curriculum and not a stand-alone activity | 29 (23.2%) | 61 (48.8%) | 16 (12.8%) | 3 (2.4%) | 16 (12.8%) | 125 (100%) |
| 14 | Simulation-based activities should be introduced in the undergraduate curriculum from year 1 | 24 (19.2%) | 42 (33.6%) | 35 (28%) | 1 (0.8%) | 23 (18.4%) | 125 (100%) |
| 15 | Simulation tools are the best choice for teaching my subject area | 23 (18.4%) | 28 (22.4%) | 61 (48.8%) | 1 (0.8%) | 12 (9.6%) | 125 (100%) |
| 16 | My institute supports the integration of simulation | 22 (17.6%) | 43 (34.4%) | 45 (36%) | 2 (1.6%) | 13 (10.4%) | 125 (100%) |
| 17 | I have easy access to the facilities needed to assist me in the integration of simulation in my teaching | 13 (10.4%) | 33 (26.4%) | 50 (40%) | 5 (4%) | 24 (19.2%) | 125 (100%) |
| 18 | I need formal training to integrate simulation into the curriculum | 29 (23.2%) | 57 (45.6%) | 17 (13.6%) | 5 (4%) | 17 (13.6%) | 125 (100%) |

SBE: Simulation-based Education

The too busy schedule of the simulation center, insufficiently equipped laboratory, and the number of students per faculty; it is hard for one faculty to manage the students in simulation education, and lack of cooperation of leaders and other faculty members as it requires a lot of work early on and possibly a committee on its own to establish the rubrics for each subject and make the necessary refinement as needed. In addition, some community health departments are not using simulation as mentioned by the faculty, 'it is unavailable in the department to be applied or used for the students.

Some of the faculties answered that no barriers were observed, but simulated education is not an original component of the curriculum and is only used as a backup.

## Discussion

Presented herein is the general perception and attitude of 125 faculty members about SBE application in the Colleges of Applied Medical Sciences in the Kingdom of Saudi Arabia. The general perception toward SBE was positive. The main findings of this study are that faculty members in the CAMS perceive SBE as an enjoyable way to teach, it increases students` interest and is considered an effective assessment tool to evaluate students` learning, improving learning outcomes, gives more freedom compared with actual wards and clinics, the best way for teaching communication skills, and improving patient safety. With a mean score of 3.86±0.90. With this regard, the perception of faculty members toward SBE in this study is similar to students` perception in health colleges reported in other studies [1, 33, 34]. The students responded positively and believed that the simulations helped them better understand concepts, were a valuable learning experience, helped to stimulate critical thinking, and were realistic. The students also found that the knowledge gained from simulations can be transferred to real-life and clinical practice and that the simulations must be included in the undergraduate curriculum [33].

**Table 6** Means and standard deviations of the sample responses sorted in descending for each Item of the first dimension

| No. | Item | Mean | SD | Perception level | Order |
|---|---|---|---|---|---|
| 4 | Simulation-based teaching can improve learning outcomes. | 4.07 | 0.96 | Positive | 1 |
| 3 | Simulation is an effective assessment tool to evaluate students' learning. | 3.97 | 0.88 | Positive | 2 |
| 2 | Students show more interest when I use simulation tools. | 3.94 | 0.87 | Positive | 3 |
| 7 | Simulation-based education improves patient safety. | 3.86 | 0.90 | Positive | 4 |
| 1 | I enjoy my teaching more when I use simulation. | 3.80 | 0.90 | Positive | 5 |
| 6 | Standardized patient is the best tool for teaching communication skills. | 3.75 | 0.91 | Positive | 6 |
| 5 | There is more freedom to learn in a simulated environment than learning in real wards or clinics. | 3.61 | 0.99 | Positive | 7 |
| | **General perceptions level** | **3.86** | **0.74** | **Positive** | |

**Table 7** Means and standard deviations of the sample responses sorted in descending for each Item of the second dimension

| No. | Item | Mean | SD | Anxiety level | Order |
|---|---|---|---|---|---|
| 8 | I need extra support to function effectively in simulation-based teaching. | 3.84 | 0.87 | High | 1 |
| 12 | Interaction with standardized patients makes students communicate in an artificial manner with real patients. | 3.58 | 0.94 | High | 2 |
| 10 | It takes more time to plan teaching with simulation tools rather than with real patients in student learning. | 3.52 | 0.94 | High | 3 |
| 9 | I face problems in managing students in simulated teaching. | 3.18 | 0.83 | Moderate | 4 |
| 11 | I avoid the integration of simulation in my courses. | 2.99 | 1.06 | Moderate | 5 |
| | **General anxiety level** | **3.42** | **0.75** | **High** | |

**Table 8** Means and standard deviations of the sample responses sorted in descending for each Item of the third dimension

| No. | Item | Mean | SD | Perception level | Order |
|---|---|---|---|---|---|
| 13 | Simulation should be a part of the medical curriculum, not a stand-alone activity. | 3.78 | 1.02 | Positive | 1 |
| 18 | I need formal training to integrate simulation into the curriculum. | 3.70 | 1.09 | Positive | 2 |
| 16 | My institute supports the integration of simulation. | 3.56 | 0.95 | Positive | 3 |
| 14 | Simulation-based activities should be introduced in the undergraduate curriculum from year 1. | 3.52 | 1.03 | Positive | 4 |
| 15 | Simulation tools are the best choice for teaching my subject area. | 3.48 | 0.93 | Positive | 5 |
| 17 | I have easy access to the facilities needed to assist me in the integration of simulation in my teaching. | 3.20 | 1.00 | Moderate | 6 |
| | **General perceptions level** | **3.54** | **0.79** | **Positive** | |

Many studies have demonstrated the importance of simulation as a teaching tool for healthy college students [33–35, 37]. The literature highlighted that students perceive SBE promotes learning outcomes [31, 32].

However, our results demonstrate that most CAMS faculty members have high levels of anxiety toward SBE. Faculty members agree and strongly agree with the statement that they need extra support to function effectively in simulation-based teaching and need more time to plan teaching with simulation tools compared with real patients. Unlike another study done in Saudi Arabia to

evaluate the perception of medical teachers, their findings demonstrated that medical teachers have low levels of anxiety toward SBE [26]. The study compared the results for medical teachers in basic/clinical sciences, and they found that (59%/57.9%) disagree and strongly disagree with the statement that they avoid integrating simulation in their teaching [26]. Moreover, (42.3%/40.5%) of basic/clinical sciences medical teachers strongly agree that interaction with standardized patients will make the students interact artificially with actual patients.

Additionally, the results highlight that faculty members` perception was positive toward the integration of simulation in education. Faculty members agree and strongly agree with the statement that simulation should be a part of the medical curriculum and not a stand-alone activity, simulation-based activities should be introduced in the undergraduate curriculum from year 1, and simulation tools are the best choice for teaching their subject area. It has been demonstrated that the early introduction of SBE for basic clinical skills may simplify the integration of clinical and basic science knowledge, which may also increase student motivation and self-esteem [36, 38, 39].

Our findings also show that there was a statistically significant difference between the responses of the faculty members based on the training they received in simulation based on age, education level, and occupation. The rate of participants who received formal training for simulation was higher in 40–59 years (62.5%), holding a Master's degree (65%) and working as Associate Professors and Professors (50%). Compared with the study that

was done in Saudi Arabia to assess medical teachers' perception, the demographic factors of age, gender, received training, and perception of SBE, its anxiety, and integration were not statistically different [26].

Our study also identifies faculty members' perceived barriers toward the integration of SBE, and the most frequently mentioned barriers were time, training, facilities, resources, access, and simulation labs/simulation classrooms. Compared to the other studies, curriculum design was one of the major barriers to the integration of SBE [26]. Another study aimed to assess the perceived barriers in applying simulation classes and reported the lack of interest to participate, lack of timely and effective feedback, and the high number of students in each class as perceived barriers to SBE [34].

This study has some strengths. First, this is a multicenter study; the population of participants was drawn from multiple institutions/universities in Saudi Arabia with different histories of curricular SBE. Thus, the findings can represent and generalize the perception of other institutions. Second, external validity and lower systematic bias compared to a single institution dataset. Third, to the best of our knowledge, this is the first study in Saudi Arabia that assessed faculty perception towards SBE in the community health sciences departments. Fourth, this study includes diverse faculty with various levels of experience and educational levels. Fifth, the second objective was to identify faculty members' perceived barriers toward the integration of SBE, so this study offers the chance to identify the barriers and offer some solutions.

This study also has its limitations. Since data collection depended on a self-administered questionnaire, low response rates were the biggest challenges we faced. Other limitations related to self-administered questionnaires include misunderstanding, over/underestimation, and low monitoring ability. There is a possibility of selection and response bias even with anonymity since the faculty doesn't have the same access or engagement with social media. The results can't be generalized and may not be representative of the entire population of faculty members in Saudi Arabia to other programs because of the study design (cross-sectional). The interview was the best choice to take the expert opinion, but due to the lack of time and resources, we chose social media platforms and university emails to take the responses. As well, the sampling method we chose (snowball sampling) limited the ability to calculate the response rate. However, further observational and experimental studies are needed to assess the effect of SBE on learning and healthcare outcomes among students and healthcare practitioners.

## Conclusion

The study's key results demonstrate the positive perception and attitude of medical teachers towards the SBE to be used for clinical nutrition undergraduate practical courses. However, the results show high levels of anxiety among faculty members toward SBE. For the effective use of simulation in practical courses, the study identifies the need for training, support, and evaluation of faculty members in SBE. Our findings highlight the barriers that CAMS administrations must address to support the integration of SBE in undergraduate practical courses, develop a faculty training program, and assess its impact. Further research is needed to be done in Saudi Arabia to demonstrate the SBE outcomes in the level of education and healthcare practice.

### Abbreviations
CAMS    Colleges of Applied Medical Sciences
IRB        Institutional Review Board
OSCE    Objective Structured Clinical Examination
SBE      Simulation-based Education

### Data availability
The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

## Declarations

### Ethics approval and consent to participate
The study was reviewed and approved by the Institutional Review Board (IRB) of King Saud University, Riyadh (IRB No. 23–353). Permission to conduct the study was also obtained from the deans of the CAMS. The participants were informed about the study at the beginning of the questionnaire, and no identifying data was collected. Informed consent has been obtained from all the participants.

### Consent for publication
Not applicable.

### Competing interests
The authors declare no competing interests.

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