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Effect of modified physiology laboratory sessions on the awareness and knowledge of obesity of health-related university students

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Abstract:

BACKGROUND: Obesity is a global health problem of immense magnitude. Increased awareness and knowledge about obesity in health-care providers are essential to addressing this global issue. The aim of the present study was to assess the baseline knowledge on obesity of university students in health-related programs and evaluate the effectiveness of modified physiology laboratory (MPL) sessions in enhancing the awareness of obesity of these students by repeated exposure to physiological differences between normal weight (NW) and overweight or obese (OW/OB) individuals.

MATERIALS AND METHODS: It was a quasi-experimental study in which three regular physiology laboratory exercises were modified (MPL) to address different aspects of obesity. A total of 319 students (181 male and 138 female) from health-related colleges taking the physiology course during academic session 2011–2012 were included in the study. A questionnaire on obesity served as a measure of prior knowledge and improvement of evolution of student knowledge. The questionnaire was administered thrice: Beginning of the first MPL session (pretest), at the end of the second session of the first MPL (posttest-1), and the end of second session of the final MPL (posttest-2). Correct knowledge (CK), perceived knowledge (PK), and accuracy of knowledge (KA) were evaluated. Students gathered and analyzed physiological data in these sessions to explore the differences between NW and OW/OB subjects.

RESULTS: The students' level of PK on obesity was high, but KA was low in pretest. The three knowledge indices improved significantly (P <0.001) from pretest (PK = 77.2%; KA = 52.8%; CK = 40.5%) to posttest 1 (PK = 93.5%; KA = 70.1%; CK = 65.9%). However, from posttest 1 to posttest 2, only small but significant increments were observed in CK (10.5%) and KA (8.7%).

CONCLUSION: The awareness and knowledge on obesity of health-related undergraduate university students at baseline were low, but significantly improved after MPLs. The students' knowledge did not only increase but also improved in accuracy. This increase in awareness and knowledge of obesity is expected to directly impact on the students' lifestyles and boost their confidence to counsel others on obesity.

Keywords:

Correct knowledge, knowledge accuracy, obesity awareness, obesity indices, perceived knowledge

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Introduction

Obesity is a global health problem of immense magnitude.[1] Driven by social and economic changes, the prevalence of overweight and obesity worldwide is increasing at an alarming rate,[2] Obesity is involved in the pathogenesis of major diseases, especially diabetes and cardiovascular disease, that lead to an increased risk of premature death.[3,4] Many public health experts classify the prevailing

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rise in obesity as an epidemic.[5] Obesity is a disease with complex causation rather than merely an issue of will power and lifestyle.[1] Genetic, psychological, and environmental factors also play important roles.[6,7] The development of effective and long-lasting preventive strategies requires that obesity be acknowledged as a serious problem.[8,9]

Although the problem of obesity with its attendant comorbidities continues to increase throughout the world, medical students in universities have neither the knowledge nor an appreciation of this problem.[10-12] One important consequence of this lack of awareness is the failure to identify obesity, resulting in inaction on part of an individual.[13] Cues of personal relevance or an accumulation of cues are likely to motivate one to take action and modify one's health behavior.[14] Repeated exposure to different aspects and deleterious effects of obesity could fashion better-equipped, motivated health-care providers whose contribution to the fight against obesity would be more effective at the personal and community levels.[15,16] It was hypothesized that a series of modified physiology laboratory (MPL) exercises with educationally appropriate material on obesity would improve the awareness and knowledge of obesity of health-related university students.

The objectives of the study were to (i) assess prior (baseline) knowledge of university students on obesity, (ii) evaluate the effectiveness of MPL sessions in enhancing the awareness of obesity, (iii) compare the prior knowledge of groups of students by gender (males versus females) and major disciplines (medical versus other health related), and (iv) compare the evolution of knowledge in different groups of these students.

Materials and Methods

Ethical approval was obtained from the Institutional Review Board of Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia, and informed written consent taken from all participants. It was a quasi-experimental study in which three regular physiology laboratory sessions as prescribed in the college curriculum were modified (MPL). Included in the course of the physiological principles and scientific method of these laboratory sessions was the real-life global problem of obesity.

All registered second-year male and female students in the academic session 2011–2012, in the Colleges of Medicine, Dentistry, and Applied Medical Sciences (Physiotherapy, Respiratory Care) in the University, who were taking physiology as an essential component of their course work, were included in this study. The students were in the department of physiology for the first time but had already taken courses in biology, chemistry, and physics. No other concurrent courses in the curriculum addressed the topic of obesity during the time of the study (September 2011 to March 2012). A questionnaire, validated by two experts familiar with obesity awareness programs and pilot tested the previous year was used as an instrument to determine the knowledge and awareness of obesity. The data from the subjects in the pilot test were not included in the results. A total of three MPLs with two sessions each were spaced over a period of 6 months starting in the 2nd week of September 2011. In the first 20 min of the first session, the students were given a brief introduction to the MPL program and its objectives and were asked to answer a questionnaire (pretest 1). One male-trained and one female-trained faculty members supervised and executed the protocol in a standardized manner. The students were assured that their personal data would be kept confidential, and that the results of the questionnaire would have no bearing on their grades. The students completed the questionnaire in initial 20 min and handed them over to the faculty, who then briefed them on the protocol for obtaining various measurements. Written instructions were provided in each data-acquiring laboratory session giving a detailed description on how to obtain anthropometric data, resting heart rate (RHR), percentage body fat, blood pressure (BP), and electrocardiogram (ECG) for sinus arrhythmia (SA) measurements. Every student was provided with a sheet of paper on which their demographic details and the data they had collected during the laboratory work were to be entered.

Briefly the protocols of three MPLs were as follows: in the first MPL, the students measured the weight, standing and supine height, waist circumference (WC), hip circumference (HC), and calculated body mass index (BMI) in kg/m^2, waist-to-hip ratio, waist-to-stature ratio and compared their data with standard charts. Students recorded RHR in standing and supine positions. The difference between standing and supine height and RHR was calculated.[17,18] In the second MPL, the students measured skin-fold thickness, with the help of skin calipers, at designated sites and calculated body density and body fat percentage with standard equations.[19] Resting BP in the standing and supine positions was recoded with SPOT vital-sign monitor. In the third MPL, the students recorded the ECG of the patient breathing normally in a resting position, and then, at 6 breaths/min for 1 min, to observe SA. SA is an increase in HR during inspiration and decrease in HR in expiration and is maximally exaggerated at 6 breaths/min. Expiratory-to-inspiratory ratio was calculated in the each cycle of respiration for 6 cycles.[20,21] The effects if any of the obesity status on spinal shrinkage, RHR, BP, and SA were explored. The physiological data obtained

are not presented in this study as it was not within the scope of the study.

Every student had to actively participate in the acquisition of data, acting in pairs both as a subject and an experimenter. Data acquisition was followed by a week of research, during which students were encouraged to go through textbooks, electronic resources, and make inquiries from peers and seniors. Analyzed cumulative data were presented and discussed in the 2nd session of the first MPL the following week, when the results were compared with published data. Feedback on the queries of students was provided either by fellow students or the facilitator. A postlab questionnaire was administered immediately at the end of the second session of the 1st MPL, conducted in the 3rd week of September 2011, in the same manner as the prelab questionnaire (posttest 1). The second MPL was conducted in a similar fashion but without questionnaires. During the third and final MPL, which was conducted in March 2012, the questionnaire was administered (posttest 2) at the end of the 2nd session in the 3rd week of March 2012.

The questionnaire was divided into four subcategories with a total of 20 theme-specific knowledge questions relating to (1) general awareness of obesity, (2) methods of assessing obesity, (3) the extent and seriousness of the problem, and (4) understanding/ability to link variations in physiological parameters to obesity. All the single best multiple-choice questions (MCQs) contained the option "I don't know" and students were instructed that they should mark that option if they were not sure of the correct answer. They were told that they were not expected to know the correct answer for most of the questions.

The advancement of knowledge was evaluated by calculating and following three indices: Correct knowledge (CK), perceived knowledge (PK), and accuracy of knowledge (KA).[22] CK was calculated by dividing the number of correct responses by the total number of MCQs. PK was calculated by dividing the total number of questions answered (correct plus incorrect) by the total number of questions in the questionnaire. KA was calculated by dividing the number of correct responses by the number of questions answered (correct + incorrect). To ease mathematical calculations, each index was multiplied by 100.[22] Thus, the indices are presented in the form of percentages. Analysis of the pre- and post-lab responses was performed to evaluate the benefits derived from the laboratory sessions.

Statistical analysis of the data was performed using the Microsoft Excel and Statistical Package for the Social Sciences (IBM®SPSS® Statistics) version 26 (IBM, USA). All the results are means of percentages ± standard error of the mean (SEM). The evolution of knowledge from the pretest to posttest 1 and posttest 2 was explored using a paired *t*-test. Differences between the groups (gender and major discipline) were evaluated using the independent sample *t*-tests. CK was compared to PK in a similar way. The relations between knowledge indices were assessed through the Pearson regression analysis.

Results

Out of a total of 339 registered students, 319 (181 boys and 138 girls) participated in the MPLs. Because the MPLs were part of the regular curriculum, all the students without exception were supposed to attend. The absentee rate was 5.9%. As a cohort, the students had a mean score of 40.5% for correct prior knowledge on obesity. The students answered 40.79% of MCQs correctly, 36.53% incorrectly, and 22.69% as "Do not know." Table 1 shows that the female students had a significantly (P = 0.000) higher (%±SEM: 47.3 ± 1.1) correct prior knowledge than the males (35.5 ± 1.2). This pattern was evident in both medical students (females: 50.8% vs. males: 40.0%) and students in other health-related colleges (females: 41.4% vs males: 30.2%). KA was significantly (P = 0.000) higher in females (%±SEM: 60.3 ± 1.1) than in males (47.3 ± 1.3), but there was no statistically significant difference in the PK on obesity in the genders (P = 0.061). Medical students had significantly (P = 0.000) higher prior CK, PK (0.0001), and KA (0.000) than the students of other health-related colleges. Figure 1a shows that prior CK correlated significantly and positively with PK for the entire cohort of students (Pearson correlation = 0.561; P = 0.000).

Table 2 shows the advancement of knowledge indices for the entire cohort of students. From pretest to posttest 1, all three knowledge indices increased significantly (P = 0.000). The greatest increase was in CK (from 40.5 ± 0.9 to 65.8 ± 1.0). CK (P = 0.003), and KA (P = 0.004) also increased significantly from posttest 1 to posttest 2, respectively. This increase was, however, not associated with a significant increase in PK (P = 0.197) from posttest 1 to posttest 2. The subgroups based on gender and major disciplines behaved in the same way as the entire cohort in terms of evolution of knowledge from pretest to posttest 1 [Table 3]. Figure 1b depicts that in the whole cohort, the change in knowledge from pretest to posttest 1 correlated significantly and negatively with prior CK (Pearson correlation = −0.433; P = 0.000).

Theme specific PK was high (>80%) for general knowledge on obesity, the magnitude of the problem, and physiological effects of obesity, but the KA was quite low (55.3, 48.3, 47.9% respectively) [Table 4].

Table 1: Comparison of prior knowledge indices in student groups based on gender and major discipline

	N	Correct knowledge Mean±SEM	Perceived knowledge Mean±SEM	Knowledge accuracy Mean±SEM
Groups based on gender				
Male	181	35.5±1.2	75.7±1.5	47.3±1.3
P-value		<0.001	0.061	0.000
Female	138	47.3±1.1	79.2±1.3	60.3±1.1
Groups based on majors				
Medical	186	44.9±1.2	80.5±1.2	56.1±1.3
P-value		<0.001	<0.001	<0.001
Nonmedical	133	34.4±1.2	72.5±1.7	48.0±1.4

Values are means±SEM. Nonmedical: includes dentistry, physiotherapy, and respiratory care students. Comparison between the groups based on gender and major discipline done through unpaired *t*-test. *n*=Number of students, SEM=Standard error of the mean

Table 2: Advancement of knowledge from pretest to posttest 1 and posttest 2 in all students

Knowledge index	Pretest (*n*=319) Mean±SEM	Posttest 1 (*n*=319) Mean±SEM	Posttest 2 (*n*=181) Mean±SEM	Δ Posttest 1 - Pretest	Δ Posttest 2 - Posttest 1
Correct knowledge	40.5±0.9	65.8±1.0	76.3±1.1	25.3 *P*<0.001	10.5 *P*=0.003
Perceived knowledge	77.2±1.0	93.5±0.5	96.7±0.7	16.3 *P*<0.001	3.2 *P*=0.197
Knowledge accuracy	52.8±1.0	70.1±0.9	78.8±0.9	17.3 *P*<0.001	8.7 *P*=0.004

Δ= greek letter delta denotes "change". Values are means of percentages±SEM. *P* values show the significance from preceding test. *n*=Number of students, SEM=Standard error of mean

Table 3: Advancement of knowledge score from pretest to posttest 1 in students groups based on gender and major discipline

Knowledge index	Group (*n*)	Pretest Mean±SEM	Posttest 1 Mean±SEM	Increment	*P-Value*
Groups based on gender					
Correct knowledge	Male (181)	35.5±1.2	59.6±1.2	24.2	<0.001
	Female (138)	47.3±1.1	73.9±1.3	26.9	<0.001
Perceived knowledge	Male (181)	75.7±1.5	92.1±0.8	16.4	<0.001
	Female (138)	79.2±1.3	95.3±0.6	16.3	<0.001
Knowledge accuracy	Males (181)	47.3±1.3	64.5±1.2	17.4	<0.001
	Females (138)	60.3±1.1	77.2±1.1	17.1	<0.001
Groups based on majors					
Correct knowledge	Medical (186)	44.9±1.2	71.3±1.2	26.4	<0.001
	Non-medical (133)	34.4±1.2	58.2±1.4	23.8	<0.001
Perceived knowledge	Medical (186)	80.5±1.2	95.9±0.5	15.4	<0.001
	Non-medical (133)	72.5±1.7	90.2±1.0	17.7	<0.001
Knowledge accuracy	Medical (186)	56.1±1.3	74.1±1.1	18.0	<0.001
	Non-medical (133)	48.0±1.4	64.4±1.3	16.4	<0.001

Values are means of percentages±SEM. Nonmedical: includes dentistry, physiotherapy, and respiratory care students. *n*=Number of students

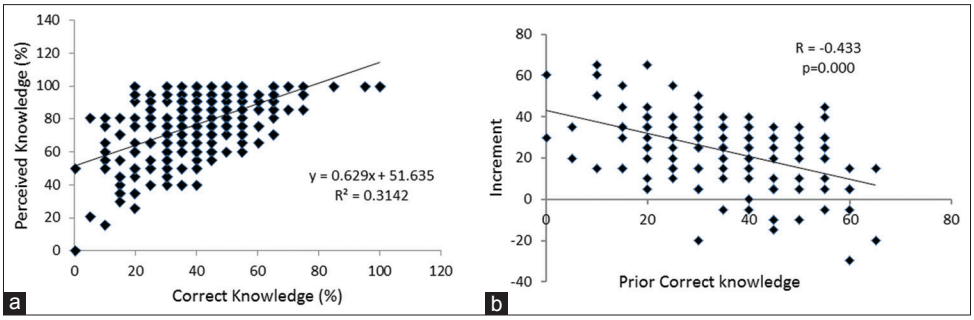

Figure 1: (a) The relationship between prior correct knowledge and perceived knowledge; (b) relationship between the prior correct knowledge and the increment in correct knowledge from pretest to posttest 1 *n* = 319

Table 4: Correct knowledge, perceived knowledge, and knowledge accuracy of all students of the 20 multiple-choice questions in the different question categories

Test index	Knowledge index	Knowledge category			
		General knowledge	Assessment methods	Magnitude of problem	Physiological effects
Pretest (*n*=319)	Correct knowledge	47.5	30.0	40.2	38.6
	Perceived knowledge	84.5	60.3	80.8	80.2
	Knowledge accuracy	55.3	49.3	48.3	47.9
Posttest 1 (*n*=319)	Correct knowledge	63.1	68.5	65.4	74.3
	Perceived knowledge	93.9	92.1	94.0	95.7
	Knowledge accuracy	66.7	74.4	69.5	77.7

Data is in means of percentages. *n*=Number of students

In posttest 1, there was a significant improvement in KA in all these categories (66.7%, 69.5%, and 77.7%, respectively). Regarding the methodology for obesity assessment, both PK (60.3%) and KA were low (49.3%) and showed significant improvement (PK: 92.1%, KA: 74.4%) as a result of MPL. In the pretest, the students scored less on questions addressing WC and HC (36.9%) compared to the questions on BMI (50.0%). This improved significantly (P = 0.000) in posttest 1–74.03% and 77.16%, respectively.

Discussion

The results of the present study showed that the 2nd year university students as a cohort were generally not well aware of the magnitude of the problem and had inadequate knowledge about the various aspects of obesity when they started the physiology course at the university.

Similar findings of deficient knowledge and awareness of obesity have been reported of first through 4th-year medical students regarding screening recommendations and identification of BMI percentile cutpoints in children.[12] Another study found that the 1st year medical students scored significantly less (48%) than final year students (60%), their knowledge of the etiology, diagnosis, and treatment of obesity being inadequate.[11] This difference in the knowledge of obesity has also been observed in primary care providers and nurses, and it has been suggested that additional educational training could enhance their confidence in the management of patients' weight.[23] The lack of awareness and knowledge could lead to suboptimal identification of obesity by the medical care providers, and consequently, the failure to counsel and manage these obese/overweight patients appropriately.[24,25]

The three MPLs in the present study were effective in enhancing the awareness and knowledge of obesity. It has been observed that curricula that include obesity at various levels of study improve students' knowledge over time as is reflected in the improved scores of senior medical students compared to those of the 1st year students.[11] An integration of a 4-week nutrition module in the ambulatory care rotation significantly improved the nutrition-related knowledge of the 4th year medical students, from 49% to 69%, compared to the control group, which exhibited no significant difference in knowledge during the same period of time.[16] Learning and retention are better and more beneficial with brief multiple properly spaced sessions than single lengthy lessons.[26,27] Repeated exposure to personal cues is likely to motivate a person to take action and modify their health behavior.[14] Personal life-style habits of future health-care providers have been shown to affect their counseling practices to the patients. Medical students who engaged in strenuous physical activity were found to recommend physical activity more frequently to their patients.[28]

For appropriate action to be taken, genuine knowledge and not simply a belief in the self is required. A high level of CK about any issue is an indicator of awareness and its increase reflects an increase in awareness. PK is merely an indication of previous exposure to the information regardless of, the reliability of its source. Our study found that students generally had low KA and high PK at baseline, but after MPLs, there was a 25% increase in CK with associated 17% increase in KA. Although high PK may boost morale and improve motivation and satisfaction,[29,30] it has serious disadvantages such as an overestimation of one's knowledge, which could impede the search for the correct information.[31]

The differences in prior CK between males and females on one hand and medical and other health-related students on the other could be due to inherent factors or factors related to the sources of information. Females are generally more critical of their body image and shape, and may therefore more actively seek relevant information.[32,33] The converse is that men are more likely to under-perceive their body size than women and may not be inclined to seek information.[34]

A study that explored the nutrition knowledge of different cohorts in Australia reported PK of 88%, 87%, 72%, and 83% in medical practitioners, medical students in their clinical years, nursing students, and theology students, respectively, but the KA for these groups

differed markedly (76%, 76%, 44%, and 30%).[22] The PK of our students was as high as that of Australian medical students, but their KA was comparatively lower. A likely reason is that since the Australian students were in their final clinical years, they would have had greater exposure to medical practice.

The high level of PK in this study was further explored by an extrapolation of the regression line to zero accurate knowledge that gave a PK of 50% [Figure 1a]. Put another way, a student may believe that he knows the answers to 50% of the questions but may not actually know the answers to any of the questions.

Both PK and KA on the assessment methods of obesity were low. Compared to knowledge on BMI, there was a marked deficiency in knowledge about WC, although this is considered to be more indicative of abdominal obesity.[35] Inaccuracies in the estimation of weight and even actual measurements of anthropometric data by medical practitioners have been reported.[36,37] This lack of recognition and consequent slackness in actual measurement of WC and HC may reflect a lack of concern about obesity and could lead to the failure to counsel patients.[38-40]

Another important finding is that the increment in CK from pretest to posttest-1 correlated significantly and negatively with the level of prior knowledge [Figure 1b], meaning that those with low prior CK had learnt more than those with higher prior knowledge. This might be taken to indicate that such interventions might be especially beneficial to those students who are illinformed or misinformed. Inaccurate, fragmented knowledge would not lead to a change in lifestyle and obesity status of the individual,[41] but accurate clear knowledge is more likely to translate into a better lifestyle.[42] A strong association has been shown between medical students' and doctors' personal habits and their practices in preventive counseling.[43-46] Our future physicians with healthier personal habits are more likely to counsel their patients about adopting a healthy lifestyle.[47,48] Health-related colleges could contribute significantly in the prevention of obesity by designing appropriate curricula with strategies that enhance awareness and knowledge of obesity[15,28,49-51]

Limitations of this study include the absence of a control group, and the lack of follow-up in tracking the obesity status of these students long-term to establish a change in attitude toward obesity, and if the gains in knowledge were long lasting**.** It was logistically impossible under the circumstances to divide the classes into groups and complete the teaching commitments with limited staff and physical facilities. In addition, there could not be any long-term tracking owing to the clinical commitments of the students.

The strength of the present study was that with minimum additional investment of time and money, we were able to observe a significant enhancement in knowledge and awareness of students in health-related departments about the global problem of obesity.

Conclusion

The university students belonging health-related departments lacked awareness and to knowledge of obesity but exposure to the MPLs led to a clear improvement of their knowledge on various facets of obesity. As a cohort, the students not only acquired knowledge but also exhibited improved accuracy of knowledge. Multiple exposures to physiological differences between normal weight and overweight students and the timely feedback given to the students in this study might have played a significant role in improving knowledge indices.

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Conflicts of interest
There are no conflicts of interest.

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