

Prosthetic rehabilitation modalities and their socioeconomic association in a sample of adult Egyptians

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Background

Teeth loss results in significant complications that can severely affect the individuals' general health and social activities. Several studies have documented the association between socioeconomic issues and the prevalence of oral diseases and prosthetic rehabilitation. Thus, this study aimed to explore the impact of socioeconomic factors on prosthetic rehabilitation modalities in a sample of adult urban and rural Egyptian populations.

Patients and methods

A total of 400 adults of age over 18 years were included in this study. Half of them were from urban governorates (Cairo and Giza). And the other half were from the rural governorate (Al-Fayoum). Information concerning demographic (sex and age) and socioeconomic (education level, occupation, and income) factors were collected using the modified WHO questionnaire. In addition, prosthetic rehabilitation status was evaluated through intraoral examination.

Results

The percentage of female participants was higher than males in both urban and rural regions. The age range for more than two-thirds of the participants was from 30 to 60 years. In urban areas, about 39% of participants were completely dentulous, 34.5% were partially edentulous without prosthetic rehabilitation, and only 26.5% made dental prostheses. Regarding rural participants, about 35% of them were completely dentulous, 64.5% partially edentulous without prosthetic treatment, and only 0.05% received prosthesis. Comparison between the urban and rural dentition status and rehabilitation modalities showed a statistically significant difference ($P < 0.05$). Socioeconomic factors (education, occupation, and income) affect the type of prosthetic treatment modalities, particularly fixed prostheses especially in the urban area.

Conclusion

Socioeconomic determinants greatly affected prosthetic rehabilitation modalities in the studied urban and rural Egyptians. In rural areas, socioeconomic factors negatively impacted the capability of prosthetic treatment.

Keywords:

rural area, socioeconomic, prosthodontic rehabilitation, urban area

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Introduction

WHO defines oral health as 'a state of being free from chronic mouth diseases, facial pain, oral and throat cancer, oral infection and sores, periodontal disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking and psychosocial well-being' [1].

Oral health plays a fundamental role in the nutrition and general health of the human being. Caries and periodontal diseases are the main causes of tooth loss worldwide. As a consequence of teeth loss, changes in food preferences, nutritional status [2,3], self-esteem, and social activities occur. Apart from that, tooth loss has been linked to mental wellness as it influences memory and learning abilities. Furthermore, it has been considered as a potential risk factor for

noncommunicable diseases such as diabetes, heart diseases, and Alzheimer's [4,5].

For several decades, the conventional treatment of partial and complete edentulism was fixed partial dentures and/or removable prostheses either partial or complete dentures. However, with the evolution of dental implants, the possibilities of prosthetic modalities became numerous [6,7].

However, implant restorations are considered as the optimal treatment modality for tooth loss. There are several aspects that affect such treatment options

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including patient's demands, expectations, general health, cost, dental health awareness, demographic status (age and sex), as well as economic factors the last include the education level, finance, and occupation [8].

In the literature, many studies have documented the impact of demographic and socioeconomic factors on oral health status and tooth loss patterns [9]. Another important aspect to add is the area of residence either urban or rural. In a developing country like Egypt, despite great efforts to improve the health status of Egyptians, the impact of socioeconomic determinants is still dominant. However, the effect of socioeconomic factors on the prosthetic rehabilitation modalities among different areas of residence is not clear. Therefore, the aim of this study was to demonstrate the association between socioeconomic factors and area of residence among a sample of adult urban and rural Egyptians.

Patients and methods

Patients and study design

A total of 400 adult participants of age over 18 years were included in this study. Half of them were from the urban governorates (Cairo and Giza), and the other half were from the rural governorate (Al-Fayoum). For urban, all participants received their dental treatment in the dental clinics, Center of Excellence, at the National Research Centre (NRC). On the other hand, rural participants received their dental treatment via a team of specialized dentists from NRC at Al-Fayoum Governorate.

All participants received primary dental services such as tooth extraction, scaling, and dental fillings in addition to the distribution of free toothbrushes, toothpaste, mouthwashes as well as a simplified booklet on oral health education.

Ethical approval

The present study was conducted with the Code of Ethics of the World Medical Association, according to the principles expressed in the Declaration of Helsinki 1975. This study is approved by the Medical Research Ethics Committee of the NRC, Cairo, Egypt under approval no. 16/084. All patients were informed about the practical steps of this study and signed written approval consent was obtained.

Sample size calculation

The sample size calculation of this survey was calculated based on the study by Shafaei [8]. The

minimally accepted sample size was 200 per group when the alpha level=0.05, the confidence interval=95%, and the margin of error=7%.

Data collection

Information concerning demographic status (sex and age) and socioeconomic (education level, occupation, and income) factors were collected using the modified WHO questionnaire [10]. Moreover, prosthetic rehabilitation status was evaluated through intraoral examination.

Statistical analysis

Descriptive and analytical statistical analyses were performed to determine the different variables (sociodemographic, socioeconomic, and prosthetic rehabilitation modalities). Also, the association between socioeconomic factors and prosthetic rehabilitation modalities were described. Data was analyzed using SPSS 22 (Statistical Package for Social Science (SPSS)[®] Ver. 24, Microsoft Cooperation, USA), Graph pad, Excel 2019, and presented as percentages in tables. A χ^2 test was performed to compare between two or more variables. A *P* value of less than 0.05 was considered significant.

Results

Demographic data

In this study, male participants constituted about 39 and 21%, while females constituted the majority with percentages of 61 and 79% in urban and rural populations, respectively. The differences between male and female percentages were statistically significant ($P<0.05$) as shown in Table 1.

Regarding age, the majority of participants have age in the range from 30 to 60 years with percentages of 76.5 and 70.5% in urban and rural populations, respectively. On the other hand, percentages of participants older than 60 were 5 and 3% in urban and rural participants, respectively. Statistical analysis of the results revealed only a statistically significant difference for participants younger than 30 years ($P<0.05$).

Socioeconomic factors

The level of education of the studied populations is shown in Table 1. For urban participants, the student/college percentage was the highest (41.5%), followed by intermediate (40.5%), then participants who accomplished postgraduate studies (16.0%), and the lowest percentage was for the illiterate (2%). Comparison between different education levels showed a statistically significant difference ($P<0.05$).

Table 1 Socioeconomic information of rural and urban participants

Descriptive data	Urban (N=200) [n (%)]	Rural (N=200) [n (%)]	P value
Education			
Illiterate	4 (2.0)	74 (37.0)	0.0001*
Intermediate	81 (40.5)	116 (58.0)	0.0003*
Student/college	83 (41.5)	10 (5.0)	0.0001*
Postgraduate studies	32 (16.0)	0	0.0001*
P value	0.0001*	0.0001*	
Occupation			
Worker	9 (4.5)	10 (5.0)	0.81
Government employee	83 (41.5)	34 (17.0)	0.001*
Private sector	57 (28.5)	11 (5.5)	0.0001*
No	51 (25.5)	145 (72.5)	0.0001*
P value	0.0001*	0.0001*	
Income			
Fixed income	128 (64.0)	19 (9.5)	0.0001*
Nonfixed income	32 (16.0)	26 (13.00)	0.06
No income	40 (20.0)	155 (77.5)	0.001*
P value	0.0001*	0.0001*	

*Significant difference as P value less than 0.05, using χ^2 test.

In rural participants, intermediate education exhibited the highest percentage (58%), followed by illiterate (37%), and the least percentage was for student/college (5%). Furthermore, there were no participants who have achieved postgraduate studies, and the differences between education levels were statistically significant ($P<0.05$). On the other hand, a comparison between urban and rural populations regarding the different education levels revealed statistically significant differences ($P<0.05$) as displayed in Table 1.

Concerning occupation, for urban participants the results were as follows: governmental employees constituted the highest percentage (41.5%), followed by private-sector employees (28.5%), then participants who had no occupation (25.5%), and the least percentage was for the workers (4.5%). For rural, the highest percentage had no occupation (72.5%), followed by the governmental employee (17.0%), then private employees (5.5%), and the least was for workers (5%). When comparing the between urban and rural participants, the results demonstrated statistically significant difference ($P<0.05$) including all occupational categories except for workers ($P>0.05$).

The last socioeconomic factor is income; in urban participants the statistical analysis revealed that the percentage of fixed income was the highest (64%), followed by participants who had no income (20%), and the least was for nonfixed income (16%). The differences between them were statistically significant ($P<0.05$). On the contrary, most rural participants had no income (77.5%), then those who had nonfixed

income (13.0%), and the least had fixed income (9.5%). When comparing between urban and rural participants, statistical analysis demonstrated significance ($P<0.05$) except for the nonfixed income category ($P>0.05$).

Dentition status and type of prosthetic rehabilitation modalities

The dentition condition and the type of prosthetic treatment options that existed in urban and rural populations are presented in Table 2.

Assessment of the dentition and prosthetic rehabilitation existed in urban participants showed that 39% were completely dentulous without any cosmetic restorations (such as veneers or zirconia crown), 34.5% partially edentulous without any prosthetic rehabilitation, and only 26.5% of the participants had missing teeth rehabilitated with prostheses. The differences between the three conditions were statistically significant ($P<0.05$). In rural participants, the prosthetic situation was as follows: about 35% of the participants were completely dentulous, without any cosmetic restorations. Among 65% of partially edentulous participants, only 0.5% were rehabilitated with dental prostheses (only one participant). The statistical analysis revealed significant differences between the three conditions ($P<0.05$).

When comparing the results of completely dentulous participants from both urban and rural areas (Table 2), even though the urban percentage (39%) was higher than rural participants (35%), statistical analysis

Table 2 Dentition status and oral rehabilitation options in rural and urban participants

Dentition status prosthetic modalities	Urban (N=200) [n (%)]	Rural (N=200) [n (%)]	P value
Completely dentulous	78 (39.0)	70 (35.0)	0.41
Partially edentulous without rehabilitation	69 (34.5)	129 (64.5)	0.0001*
Partially edentulous with rehabilitation			
Total	53 (26.5)	1 (0.5)	0.0001*
Removable prosthesis	17 (32.1)	1 (100)	0.0001*
Fixed prosthesis	34 (64.2)	0	0.0001*
Implant	2 (3.8)	0	0.0001*
P value	0.0001*	0.0001*	

*Significant difference as *P* value less than 0.05, using the χ^2 test.

Table 3 Distribution of prosthetic rehabilitation among socioeconomic status in urban participants

Prosthetic rehabilitation	Urban [n (%)]			Rural [n (%)]
	Removable prosthesis	Fixed prosthesis	Implant	Removable prosthesis
Education				
Illiterate	3 (17.6)	1 (2.9)	0	0
Intermediate	7 (41.2)	20 (58.8)	0	1 (100)
Student	4 (23.5)	9 (26.5)	0	0
Postgraduate studies	3 (17.6)	4 (11.8)	2 (100)	0
P value	0.12	0.0001*	0.08	0.09
Occupation				
Worker	1 (5.9)	1 (2.9)	0	0
Government employee	5 (29.4)	9 (26.5)	1 (50.0)	1 (100)
Private-sector employee	4 (23.5)	11 (32.4)	1 (50.0)	0
No occupation	7 (41.2)	13 (38.2)	0	0
P value	0.003*	0.0002*	0.31	0.31
Income				
Fixed	9 (52.9)	15 (44.1)	2 (100.0)	1 (100)
Nonfixed	4 (23.5)	6 (17.6)	0	0
No income	4 (23.5)	13 (38.2)	0	0
P value	0.08	0.01*	0.08	0.31

*Significant difference as *P* value less than 0.05, using the χ^2 test.

revealed an insignificant difference between both of them ($P>0.05$). On the other hand, the percentage of missing teeth without rehabilitation in rural participants (64.5%) was higher than in urban participants (34.5%) and the results were statistically significant ($P<0.05$). Furthermore, the percentage of prosthetic rehabilitation was higher in urban participants (26.5%) compared with rural participants (0.5%) and the results were statistically significant ($P<0.05$).

When observing the prosthetic rehabilitation modalities that existed in urban areas, the majority of them had (64.2%) fixed prostheses, followed by removable prostheses (32.1%), and only 3.8% had implant prostheses. The differences between the prosthetic modalities were statistically significant ($P<0.05$). In rural areas, the only type of prosthetic restoration found was removable prosthesis in only one (100%) case, accordingly comparison between urban and rural regions revealed a significant difference

($P<0.05$) regarding all prosthetic modalities, as shown in Table 2.

The association between socioeconomic factors and prosthetic rehabilitation modalities in urban and rural participants

The association between socioeconomic factors (education, occupation, and income) and the type of prosthetic rehabilitations among urban and rural participants is presented in Table 3.

Urban

As previously shown in Table 2, the percentage of urban participants, who had prosthetic rehabilitation was 26.5% (53 participants). Among them 32.1% (17 participants) had removable prostheses, 64.2% (34 participants) had fixed prostheses, and 3.8% (two participants) had implant prostheses. On the other hand, Table 3 revealed the association between different socioeconomic factors and different types of prosthetic rehabilitation. The results were categorized according to socioeconomic factors.

Education: the association between different education levels and types of prostheses showed that the highest percentage of participants, who used removable prostheses were of intermediate education followed by student/college, then unexpectedly, illiterate and postgraduate studies revealed comparable values and the percentages were 41.2, 23.5, and 17.6%, respectively. Regarding fixed prostheses, the highest percentage was for intermediate education level, followed by student/college (26.5%), then postgraduate studies (11.2%), and finally the least percentage was for the illiterate (2.9%). On the other hand, prosthetic rehabilitation using implant restoration was found only among postgraduate studies.

Statistical analysis of the results revealed insignificant differences regarding different education levels among removable and implant prostheses ($P>0.05$). On the other hand, there was a significant difference between different education levels among fixed prostheses ($P<0.05$).

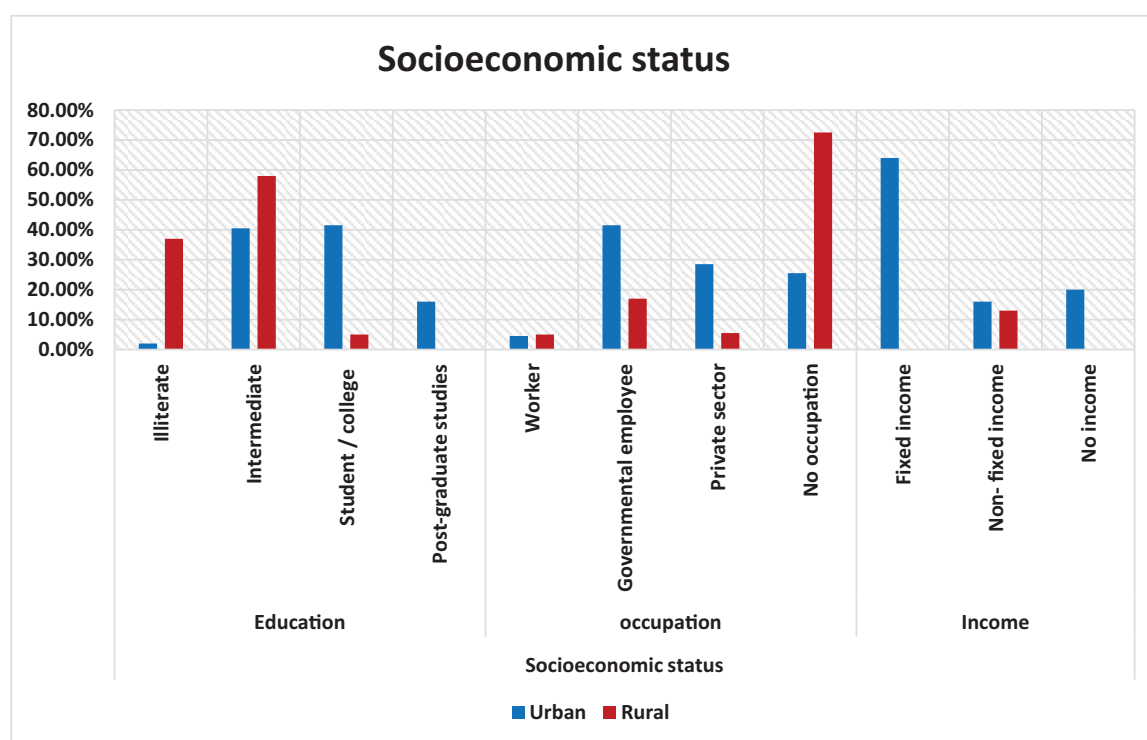
Occupation: the results showed that the type of prosthetic modalities varied among different occupations. For removable prostheses, participants who had no occupation (41.2%) consisted the highest percentage followed by the governmental

employee (29.4%), then private sector employee (23.5%), and the least percentage was for workers. Statistical analysis of the results revealed a significant difference between different occupations among removable prosthetic modalities.

Surprisingly, the highest percentage of fixed prostheses was seen among participants having no occupation (38.2%), followed by private-sector employees (32.4%), then governmental employees (26.5%), and the least percentage was for workers (2.9%). Statistical analysis of the results revealed significant differences regarding removable and fixed prostheses. On the other hand, implant prostheses were of equal percentages (50%) for each of governmental and private-sector employee (two participants for each). Comparison of the results revealed insignificant differences between different treatment modalities among occupation ($P>0.05$) except for fixed prostheses ($P<0.05$).

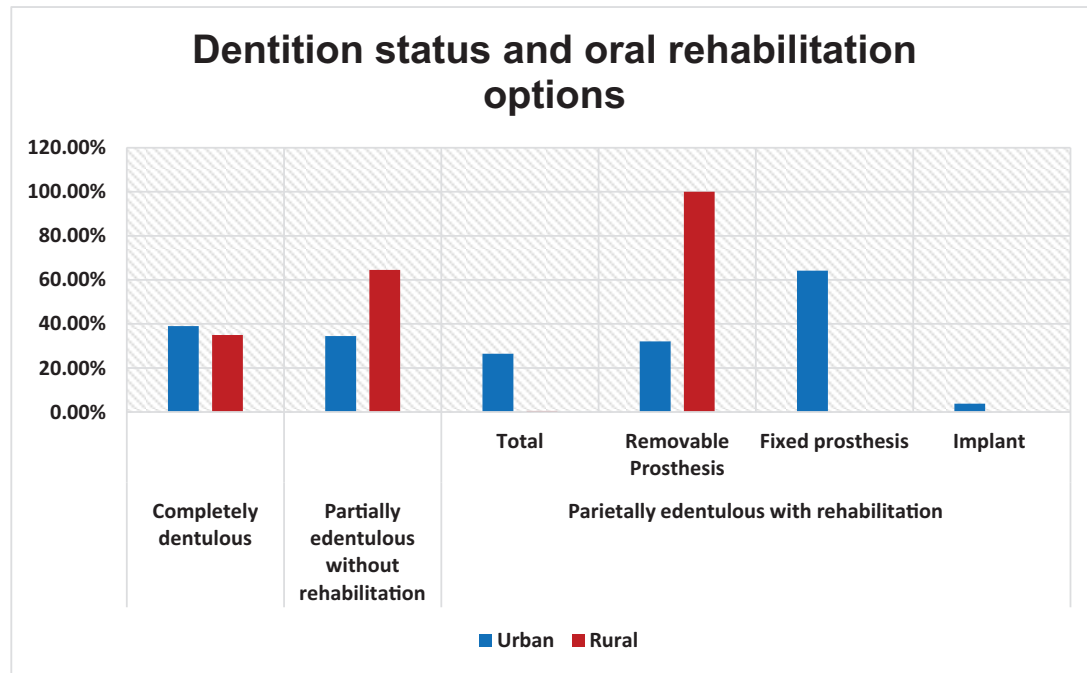
Income: the effect of income on the type of prostheses selection is shown in Table 3 and Figs 1–3. Removable prostheses were the treatment of choice among participants with fixed income, followed by nonfixed income as well as participants who had no income as the percentages were 52.9, 23.5, and 23.5%, respectively. Fixed prosthesis results demonstrated the highest in participants with fixed income

Figure 1



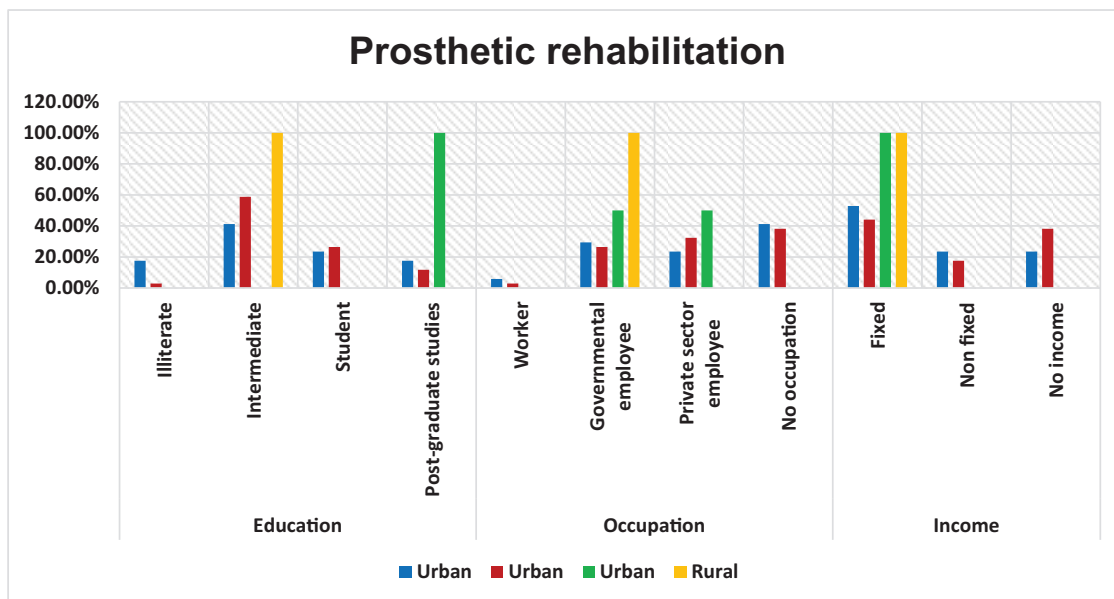
Bar chart representing socioeconomic status distribution among both urban and rural participants.

Figure 2



Bar chart representing dentition status and oral rehabilitation options among rural and urban participants.

Figure 3



Bar chart representing the distribution of prosthetic rehabilitation among socioeconomic status among urban participants.

(44.1%), followed by no income (38.2%), and the least was for participants who have nonfixed income (17.6%). Implant restoration was the treatment of choice for participants with fixed income (100%).

Statistical analysis of the results demonstrated insignificance regarding the income and two prosthetic modalities (removable and implant

prostheses) P value more than 0.05, and significant difference between income categories in fixed restorations ($P < 0.05$).

Rural

As shown previously in Table 2, the only type of prosthetic modality found among rural participants was removable prosthesis for one participant

representing 0.5% of the rural participants. This one participant was of intermediate education (100%), governmental employee (100%), and with fixed income (100%) as presented in Table 3.

Discussion

This study aimed to investigate the effect of socioeconomic variables (education, occupation, and income) on prosthetic rehabilitation modalities for missing teeth restoration in a sample of urban and rural adult Egyptians.

The outcome of the present study clearly demonstrated that females exhibited the largest proportion of participants in both urban and rural areas. The possible reason for such outcome is that females are more apprehensive and caring about their esthetics [8]. Another important finding was the age of participants, where more than two-thirds of the Egyptians with age ranged from the 30s to 60s denoting a nation with a majority of younger adults. This, furthermore, is advocated by the low percentage of elderly (above 60 years) who were less caring about dental health owing to their disabilities of health issues [11].

Furthermore, among the socioeconomic factors evaluated in the current study is education. Nearly almost all urban participants were educated to college level with 16% having accomplished their postgraduate studies, and illiterates constituted the minority (2%). On the other hand, for rural participants the results demonstrated that intermediate education comprised slightly less than two-thirds (58%) of participants and illiterates were more than one-third of participants (37%). College participants exhibited the lowest segment (5%) in rural areas, while there were no postgraduate participants (0%).

These findings verified the role of education as a substantial determinant in the urban style of living compared with rural. These outcomes were advocated by Abo Elazayem *et al.* [12], who noted an increase of illiteracy incidence in rural governorates, particularly, in females. They have also observed that the level of education could affect the patient's awareness regarding health making decisions as well as missing teeth rehabilitation.

Noteworthy, this study highlighted the differences in occupation and career prospects of both urban and rural populations in a developing country like Egypt. Among the urban, the occupation or job opportunities are

versatile (governmental employees, private sector, and workers) to accommodate the rapid and advanced lifestyle. On the contrary, career chances were limited in rural to agricultural activities and farming, in addition to, increased illiteracy and poverty in rural communities. This assumption is further supported by the income results of the present study [13].

In this study, dentition status among the urban and rural population demonstrated that more than one-third of urban (39%) participants and slightly more than one-third (35%) of the rural were dentulous without any cosmetic restorations. Furthermore, in urban partially edentulous participants without replacement and prosthetic rehabilitations cases were more than one-third and nearly about one-quarter, respectively. Among the rural participants, the percentage of tooth loss was twofold that of urban, while prosthetic rehabilitation was less than 1% of the participants.

However, the association between socioeconomic determinants and prosthetic rehabilitation modalities demonstrated a strong implication particularly among rural participants, and to a lesser extent among urban. For rural, only one government employees (0.5%) restored missing teeth with a removable prosthesis. These findings clearly demonstrate the impact of socioeconomic determinants on rural community and their capabilities to afford prosthetic rehabilitation costs, as well as the limited availability of primary dental health-care services [14,15].

Even though one-quarter of urban restored their missing teeth (26%) with dental prostheses, this percentage is lesser than those participants who have missing teeth (34.5%). These findings are in concordance with other studies [13–15], which stated that the possible reasons for such findings are lack of awareness, high cost, and fear of painful dental treatment [15,16], as well as the absence of social pressure and motivation to replace missing dentition [17].

In this study, another important observation was the influence of each socioeconomic determinant on the type of prosthetic preferences among the urban. Education was the most prominent aspect that affects the selection of treatment where three types of prosthetic modalities existed among the different education levels. The prosthetic modalities were fixed, removable (either partial or complete dentures), and implant restorations, respectively. Furthermore,

implant prostheses were related only to higher education levels. The possible explanation for such results may be attributed to the increased awareness about the importance of prosthetic rehabilitation of missing teeth [18], as well as self-esteem or possible psychosocial factors.

The income was the next main influencing factor that affected tooth replacement options in the urban population, where the removal and fixed prosthetic modalities and implant restoration were the chosen rehabilitation choices. In addition, restoration of missing teeth may also be affected not only by the absence of teeth, but many other factors such as age, cost, cultural differences, health issues, and availability of services. These outcomes were in agreement with the findings of Macek *et al.* [19].

Although, occupation is an important socioeconomic factor that could influence the prosthetic treatment modality, in the present study, its role was less effective compared with education and income.

Notably, removable prostheses and fixed partial prostheses were almost nearly the preferred treatment modalities among urban participants who had no occupation. On the other hand, fixed partial dentures were the treatment of choice for the government and private employees; however, implant restorations were the least chosen treatment option. A possible explanation for such results is that removable prostheses have been the most commonly used tooth replacement option, as it is relatively less expensive for most socioeconomic categories. As well, it is satisfactory regarding the appearance and restoration of masticatory function [20,21]. Another study reported that one of the fixed partial denture advantages is that it is completed in a relatively short time, making the duration of fixed partial denture treatment a deciding factor, which is in agreement with what is found in our study [8].

On the other hand, implant restorations were the chosen prosthetic option among a narrow class characterized by better socioeconomic status including high education level as well as good financial income.

These results are in agreement with Lath *et al.* [22], who mentioned that individuals with greater financial abilities have better access to dental care. Furthermore, individuals who have reached higher education levels were more likely to have better jobs and awareness about dental health issues. On the contrary, lack of or

inadequate education together with the absence of preventive dental services appeared to constitute a significant obstacle to dental health care [22].

Future studies are required to determine how the dental profession and society might address the increased demand for services among people who have limited financial resources. These studies would provide important understandings of the various types of assistance and insurance programs that might be designed and implemented for the benefit of the entire Egyptian community, whether in urban or rural areas.

Conclusions

Within the limitation of this study, it could be concluded that socioeconomic determinants greatly affected prosthetic rehabilitation modalities in the studied urban and rural Egyptians. Also, in urban participants, the level of education and the income affected the type of treatment modality specifically fixed prostheses, while in rural participants socioeconomic factors negatively impacted the capability of prosthetic treatment. Moreover, the present results may serve as a baseline for the future evaluation of attitudes toward the rehabilitation of missing teeth.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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