Malta Medical Journal, 32 (3): Pages (2020)
http://mmsjournals.org/index.php/mmj

MMJ

ORIGINAL ARTICLE

Vitamin D in the older population: a study of Maltese doctors' knowledge and management

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Background

Vitamin D deficiency is reaching pandemic levels in Europe. It is important for musculoskeletal health, and doctors are a crucial source of information to their patients. International studies have suggested that there is a knowledge gap amongst doctors with regards to this vitamin that can impact their management of its deficiency. In its attempt to assess the knowledge and management of Maltese doctors with regard to vitamin D in older adults, this study is the first of its kind in Malta.

Methods

Cross-sectional survey of 847 Maltese doctors. A questionnaire assessing attitudes, practices, and knowledge about vitamin D was adapted and distributed. Descriptive statistics were used, and knowledge and management scores were devised from the literature. The relationship between knowledge and management scores was correlated, and the mean scores were compared between several independent groups clustered by gender, speciality, training, work experience, and the extent of their confidence in their knowledge of vitamin D.

Results

The final recruited population was of 138 participants (7.4% margin of error assuming 95% confidence level). The mean knowledge and management scores were 33.22 (one can achieve a minimum score of -24 to a maximum of 68 points) and 23.64 (one can achieve a minimum of -9 to a maximum of 46) respectively. A positive correlation was found between the both of them (p <0.05), and doctors who felt very confident in their knowledge tended to score higher (p =0.010).

Conclusions

This study identified there is room for improvement regarding knowledge and management of vitamin D amongst Maltese doctors. Doctors that scored higher in their knowledge and management scores subjectively felt more confident in their knowledge of vitamin D. The majority of doctors (90.6%) believe there is a lack of awareness and acknowledge that more guidance is needed. Further research is required to explore whether clinical guidelines and post-graduate lectures can address this gap in knowledge of this important vitamin.

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Introduction

Vitamin D deficiency is reaching alarming levels in Europe.[1-2] This vitamin is critical to musculoskeletal health; its deficiency causes rickets in children, osteomalacia, osteopaenia, osteoporosis, muscle weakness and risk of falls in older adults. Vitamin D receptors are found in many other tissues in the body, and among others, it has been linked to an increased risk of common cancers, type 1 diabetes, osteoarthritis, cardiovascular heart disease, hypertension, depression and schizophrenia. However, literature regarding its benefits for other non-musculoskeletal medical conditions is mixed.[3-4] In spite of conflicting evidence, it continues to be a very important area for investigation, especially where older adults are concerned[5], as they are at higher risk of vitamin D deficiency. Older adults have a decreased production of this vitamin and they might be more prone to experience limited sun exposure and a decrease in dietary intake. This is found especially in those that are institutionalised.[5]

Since doctors are a crucial source of information to older adults, and are likely to visit patients who are at risk of vitamin D deficiency,[6] it is important to assess their knowledge and management of this essential vitamin. Only a few international studies were conducted to assess knowledge on vitamin D amongst healthcare professionals, and in most of them it was found that there is a knowledge gap.[7–10] This study is the first of its kind in its attempt to assess knowledge, practices and attitudes of Maltese medical practitioners with regard to vitamin D in older adults.

Materials and Methods

Population

The methodology is centred on a cross-sectional survey of all Maltese medical practitioners, excluding doctors that do not come into frequent contact with older adults (supplementary table), and doctors who were not currently practising or residing in Malta at the time of the study. All 847 medical practitioners were selected from the 'Medical and Dental Specialist Register' and the 'Principal Register' which can be found online and are regularly updated.[11] In order to construct a 95% confidence interval with a margin of error of 5%, the minimum sample should be 384 and therefore all 847 doctors were included in the study.

Information to Participants

An information letter on specifying the aims of the survey was sent by post, and included a link to the online questionnaire. Completion of the questionnaire implied consent. To increase recall,[8] participants were given the opportunity to participate in a lottery with the chance of winning a weekend break for two on a bed and breakfast basis. Information on how to take part in the lottery was provided at the end of the online questionnaire. A collective email was sent via the Maltese Ministry of Health personnel to all medical practitioners working with the government. This e-mail contained the same information as the letter and was disseminated at the beginning of data collection as well as one month later.

Ethical Approval

Ethical approval was sought from the Maltese "Health Ethics Committee", and permission to send a collective email to governmental doctors was sought from the "Ministry of Health". With permission from the authors, the

questionnaire used by Bonevski *et al.*, 2012 [8] was adapted for the purpose of this study.

Survey Instrument

The original questionnaire was developed to assess general practitioners' (GPs') attitudes, practices and knowledge about vitamin D. This study specific survey was reviewed by 11 key stakeholders in the medical field (including endocrinologists, dermatologists, vitamin D specialists, behavioural scientists, cancer experts and members of the local GP research interest groups), and then it was pilot tested.[8] The questionnaire contains 28 questions about the following domains: demographics, training and medical experience; knowledge on vitamin D; management of vitamin D insufficiency/deficiency; and doctors' opinion on if there is lack of vitamin D awareness among medical practitioners and how this could be improved. The final questionnaire takes 15 minutes to complete. Face validity of the adapted questionnaire was done by a geriatrician, GP, and a medical academic, and the online questionnaire was tested by five medical doctors who were not part of the included specialities. These were randomly selected from the medical register.

Data Analysis

The software used for data analysis was SPSS version 23. All data was of a categorical type and descriptive statistics were used to describe doctors' demographics, medical and training experience, self-reported practices, knowledge, management and attitudes on vitamin D. The questions on the domains of knowledge and management of vitamin D deficiency were given a score. Total scores for each respondent were worked out for knowledge-based and management-based questions. Knowledge-based questions assessed the understanding of groups at the most risk of vitamin D deficiency, its symptoms, and the main sources of vitamin D. On the other hand, management-based questions assessed knowledge on vitamin D supplementation in terms of pharmacotherapy and investigations required. Scores for questions were weighted depending on the perceived importance of the question as evidenced by literature. The maximum knowledge and management scores were 68 and 46, and the minimum knowledge and management scores were -24 and -9 respectively. The Pearson correlation coefficient was used to measure the strength of the relationship between the two scores, and the One-Way analysis of variance (ANOVA) test was used to compare the mean knowledge scores between several independent groups clustered by gender, speciality, training, work experience and level of confidence. The normality assumption was checked by the Kolmogorov-Smirnov test.

RESULTS

Respondents' characteristics

Of the 847 doctors, 143 completed the questionnaire. Five of these met the exclusion criteria and the final sample was of 138 doctors. This gives a response rate of 16.9% and a maximum margin of error of 7.4% assuming a 95% confidence level. There were almost equal amounts of male (*n*=65) and female (*n*=73) doctors. The majority of doctors were either GPs (*n*=72) or medical physicians (*n*=49), and almost half of the participants were still in training (47.8%) (Table 1).

Knowledge of vitamin D and Management of its deficiency

Most of the participants believe that the higher risk groups of vitamin D deficiency are older adults (87.7%), people in institutional

care (81.9%), persons suffering from malabsorptive conditions (80.4%), and those taking medications that increase vitamin D metabolism (78.3%). 34.1% of the participants defined vitamin D insufficiency as a level between 21-29 ng/ml, and 52.2% define vitamin D deficiency as a level less than 20 ng/ml.

Doctors think that vitamin D deficiency can be prevented by the adequate intake of vitamin D fortified food (83.3%) and daily vitamin D supplements (85.5%). The majority of doctors (82.6%) believe that exposure to outdoor sunlight is the main source of vitamin D in Malta. With regard to food, participants believe that fish (73.9%), cod liver oil (62.3%), milk (60.1%), and cereal (58%) have a high vitamin D content. 58% managed vitamin D insufficiency/deficiency by prescribing both vitamin D and calcium supplements, 50% by prescribing only vitamin D supplements, and 44.2% by giving advice to receive more natural sunlight.

Table 1 The gender, training status and specialty of participants.

		Sample (*n*=847)	Percentage (%)	Sample (*n*=138)	Percentage (%)
Gender	**Male**	536	63.3	65	47.1
	Female	311	36.7	73	52
Training status	**In-training**	211	24.9	66	47.8
	Not in training	636	75.1	72	52.2
Specialty	**General Practitioners**	392	46.3	72	52.2
	Medical Physicians	291	34.4	49	35.5
	Emergency Medicine	47	5.55	8	5.8
	Gynaecologists	75	8.85	5	3.6
	Orthopaedics	42	4.96	4	2.9

Note: The 1st two columns represent the original population of 847 doctors, and the last two columns represent the actual respondents of the questionnaire with the number of 138 participants. n=number; %=percentage.

The mean vitamin D knowledge and mean vitamin D management scores were 33.22 (out of 68), and 23.64 (out of 46) respectively. The Pearson correlation coefficient (0.517) is positive, indicating that knowledge and management scores are positively related (Figure 1). This relationship can be generalised as the *p* value is 0. There was no statistical difference between mean knowledge scores, and gender, training status, work experience and different specialties (Table 2).

Extent of confidence in knowledge and management

In a separate question, participants were asked how confident they feel in their knowledge of vitamin D. 10.1% (*n*=14) of doctors felt very confident, and these scored an average of 35 (SD=4.946) in their knowledge score and 30.29 (SD=5.483) in their management score. 66.7% (*n*=92) of doctors felt somewhat confident, and these scored an average of 34.36 (SD=8.542) in their knowledge score and 24.11 (SD=8.686) in their management score. 23.2% (n=32) of the participants felt not confident at all and these scored an average of 29.19 (SD=9.320) in their knowledge and 19.38 (SD=9.022) in their management score. Participants who responded as feeling somewhat confident on their knowledge of vitamin D scored significantly higher on the knowledge score than their counterparts who are not at all confident (p=0.010) (Figure 2). Participants who felt very confident scored significantly higher on management score than those who were somewhat confident (p=0.033), who in turn scored significantly higher than those who were not confident (p=0.021, see Figure 3).

Source of Information

31.2% obtained their vitamin D knowledge through online sources, 29% through medical training, 26.1% through medical journals and 21% from other medical colleagues. 90.6% of participants believe that Maltese doctors do not have enough knowledge of vitamin D, and the majority suggest further education via post-graduate lectures (61.6%) and a clinical practice guideline (61.6%).

Figure 1 The Pearson correlation coefficient (0.517) showing a positive relationship between the knowledge and management scores.

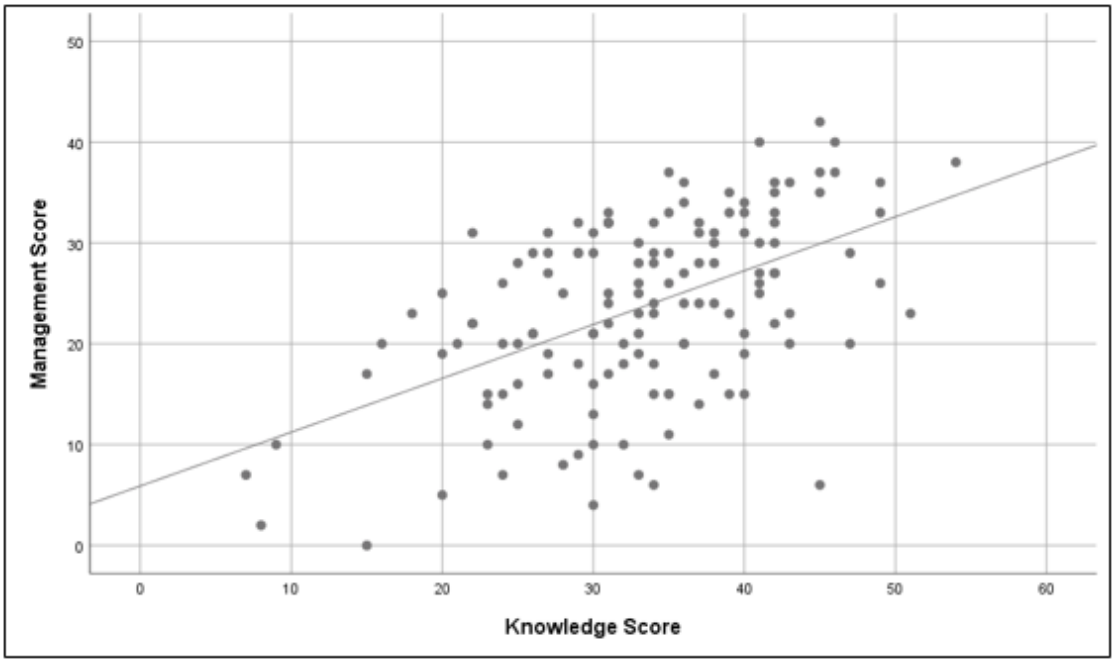


Table 2 The knowledge scores grouped by gender, training status, work experience and specialty

		Sample Size	Mean	Std. Dev	P-value
Gender	**Male**	65	32.4	9.091	
	Female	73	33.96	8.301	0.297
Training Status	**In-training**	66	33.8	8.016	
	Not in training	72	32.69	9.281	0.456
Work Experience	**<5 years**	47	32.38	9.532	
	5-10 years	24	35.25	5.666	
	11-20 years	16	35.25	7.206	
	>20 years	15	32.41	9.288	0.385
Specialty	**Medicine**	49	34.41	8.684	
	General Practice	72	33.19	8.48	
	Emergency	8	26.63	11.928	
	Gynaecology	5	34.8	4.207	
	Orthopaedic Surgery	4	30.5	5.26	0.192

Note: Std. Dev= Standard Deviation.

Figure 2 Showing the mean participants' extent of confidence in their knowledge of vitamin D deficiency. Participants who felt somewhat confident in their knowledge scored significantly higher than their counterparts who were not at all confident. Error bars represent the standard deviation. The asterix (*) represents the *p* value of <0.05.

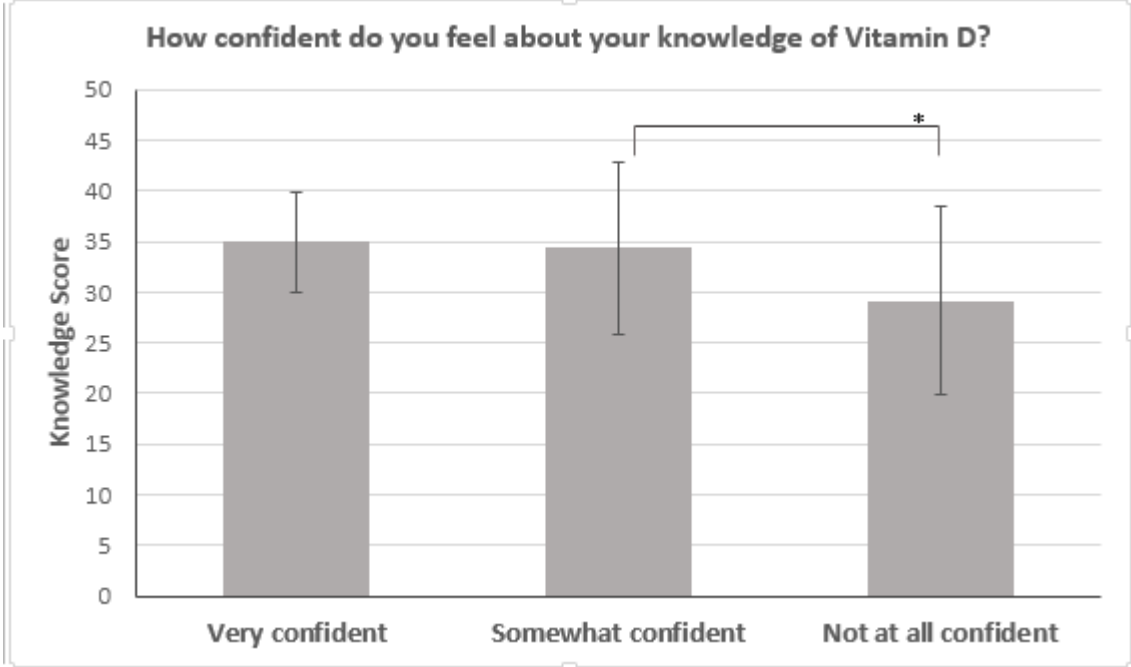
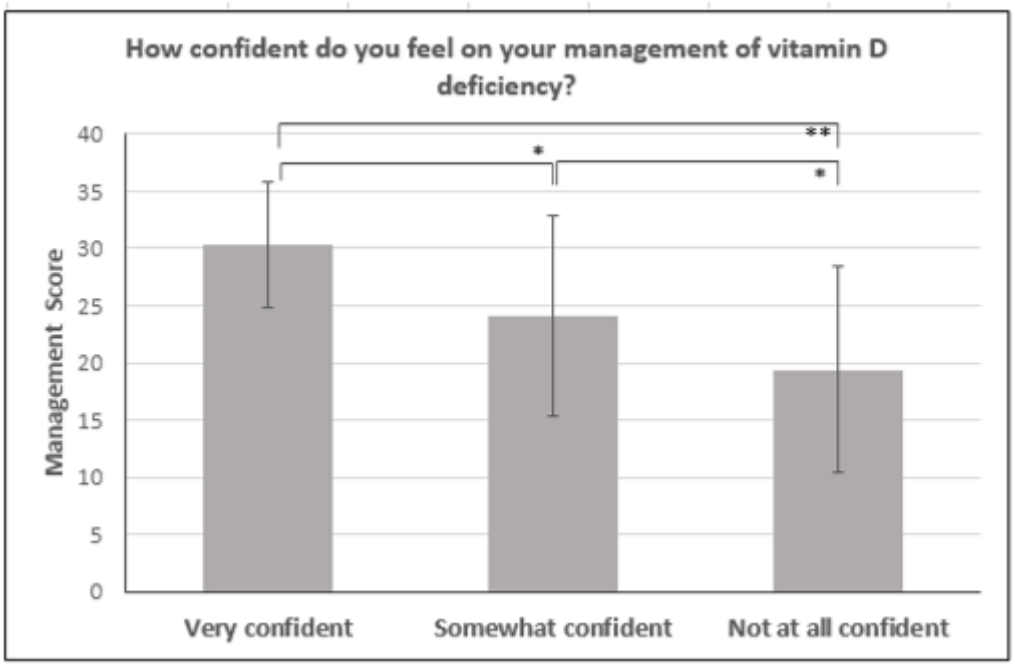


Figure 3 Showing the mean participants' extent of confidence in their management of vitamin D deficiency. Participants who felt very confident scored significantly higher on management than those who felt somewhat confident and also significantly higher than those not confident at all. Participants who felt somewhat confident also scored significantly higher than those not confident at all. Error bars represent standard deviations. The asterix (*) represents the p value of <0.05. The double asterix (**) represents the p value of <0.0001.



Discussion

Knowledge on vitamin D

This study identified that there is still room for improvement in knowledge and management of vitamin D deficiency, which is similar to other studies carried out on GPs in New Zealand[12] and Australia,[8] and on doctors working in the UK[10] and Saudi Arabia.[9] In the current study, no statistical differences were found in knowledge by gender, speciality, training status, or work experience. The reason for this could be due to the small sample size. This is in contrast to a study done in the UK where it was found that being a consultant or a GP was a significant predictor of superior knowledge of vitamin D.[10] On the other hand, in a study in Saudi Arabia, it was found that doctors in training had higher knowledge scores than consultants and resident doctors.[9]

Similar to other surveys,[8,12-13] most doctors managed to correctly identify that older adults and those in institutional care are at an increased risk of vitamin D deficiency. A fewer number of doctors recognized that individuals who are obese,[14] and/or dark-skinned individuals,[15] are also at a higher risk of vitamin D deficiency. Dark skin colour is considered to be a major contributor to vitamin D deficiency but respondents usually fail to identify this.[8]

There is some controversy about what is the optimal serum 25-hydroxyvitamin (OH) D concentration for skeletal and extraskeletal health with a general consensus to keep the concentration between 20 and 40 ng/ml.[16] The Institute of Medicine (IOM) suggests that serum 25(OH)D levels above 20 ng/ml are adequate for the general population,[17] while The National Osteoporosis Society similarly proposed that plasma levels of 25(OH)D of <10 ng/ml is considered deficient, 10-20 ng/ml inadequate, and levels of more than 20 ng/ml sufficient. However, the Maltese serum 25(OH)D reference range follows the Endocrine Society guidelines where they consider levels above 30 ng/ml to be adequate, levels between 20-30ng/ml to be insufficient, and levels less than 20ng/ml to be deficient.[18] The majority of Maltese doctors classify the deficiency as less than 20ng/ml. In most international studies the definition of adequate/insufficient and adequate vitamin D levels varied broadly.[18–20] In the discussions by Tarn *et al.*,[20] about the definition of vitamin D deficiency, most doctors failed to follow society guidelines, and some doctors used laboratory cut-off points to guide their discussions. This might be what is happening in Malta as well.

Management of vitamin D deficiency

Maltese practitioners believe that vitamin D deficiency can be prevented by an adequate intake of vitamin D fortified food and daily vitamin D supplements. Their strategy to manage deficiency is by prescribing calcium and vitamin D supplements or vitamin D supplements only. Despite this approach, there is still room for improvement, especially with regards to lifestyle advice regarding sunlight exposure and nutrition. The results are similar to the UK healthcare survey by Fallon *et al.*,[10] where lifestyle advice to have sunlight exposure and nutritional intake were recommended respectively by 50% and 47% of the survey population. There is limited evidence of benefits from daily supplementation in the general population. Bischoff-Ferrari *et al.*,[21] showed that vitamin D supplementation between 700-1000 IU reduces the risk of falling among older adults. Doses of less than 700 IU or serum 25(OH) D levels less than 20 ng/ml, may not have this effect. The combination of calcium and

vitamin D supplementation was found to better reduce falls and fractures amongst older adults.[4] There is still controversial evidence that supplementation of vitamin D lowers the risk of falls and fractures among the elderly.[22-23]

Extent of Confidence in knowledge and management of vitamin D

Maltese doctors believe that more awareness and knowledge regarding vitamin D is needed among doctors. Only a small proportion of doctors felt very confident about their knowledge of vitamin D and this is similar to the survey conducted on Australian GPs,[8] in which 13.5% felt very confident. Despite this, there were fewer Maltese doctors than Australian doctors who felt somewhat confident (66.7% vs 77.3%), in their knowledge, and a higher number of participants who did not feel confident at all (23.2% vs 9.2%).[8] In contrast, the survey conducted in Saudi Arabia showed a high number of confident participants (73%).[9] The results in context of the Maltese doctors, were not surprising, as at the time of this study, no post-graduate conferences/updates on vitamin D were conducted in Malta, and there was no national clinical guideline. When compared to a similar international survey on vitamin D knowledge,[9] this study also shows that doctors who feel more confident tend to score higher in knowledge and management scores. On the contrary, there were also studies that found no relationship[24] or an inverse relationship[25] between doctors' self-reported level of confidence and performance levels.

Sources of information

Maltese medical practitioners, similarly to those in Saudi Arabia, stated that their primary sources of information about vitamin D were obtained from online sources, medical journals and continuous medical education.[9] Therefore, this emphasizes the need for more accessible online clear guidelines in identifying risk factors and management of vitamin D deficiency. Some studies found a significant beneficial clinical outcome when doctors use clinical guidelines to help them in their practice, whilst other studies showed unclear or no benefits.[26] Newer research also shows mixed results, but a study done in 2017[27] suggests that clinical guidelines have a positive effect on individual knowledge and management behaviours.

Study Limitations

To increase the sample population, all doctors in the chosen specialities were included, with the link to the online questionnaire sent by both post and email. There may have been some participation bias, as the tool was only available online and there might have been doctors who had limited access to online services or found it more difficult to fill in due to limited information technology literacy. Moreover, doctors who were more engaged in the importance of vitamin D deficiency might have been more likely to complete the questionnaire, further creating a participation bias. A larger population would have been more ideal, as the extent to which these results can be generalised is debatable. Medical physicians, GPs, and emergency medicine physicians were well represented, but there was over-estimation in the female respondents and in doctors who are still in training (Table 1). On a positive note, participation was voluntary and it was not targeted towards doctors based on their prior knowledge or competence of vitamin D deficiency.

Conclusions and Future Recommendations

Despite that the majority of Maltese doctors correctly identified the common risk factors for vitamin D deficiency, there is still room for improvement as indicated from the mean knowledge and management scores obtained. Moreover, the extent of their confidence in their knowledge positively reflected their obtained knowledge and management scores which might indicate that improving education might boost their confidence in the subject and vice versa, but more research is needed to look into this. The majority of Maltese doctors would like to gain more knowledge on vitamin D, and therefore further research is required to explore whether clinical guidelines and the implementation of lectures in the post-graduate educational curriculum can address this knowledge gap.

Summary Box

- International studies on healthcare professionals show that some knowledge gap on vitamin D is present. This is also present among medical doctors practicing in Malta.
- This study indicates that a positive correlation exists between knowledge on vitamin D and adequate management of vitamin D deficiency.
- No difference found between mean knowledge scores and gender, training status, work experience and different medical specialties.

Acknowledgments

I would like to thank Dr Peter Middleton (Lecturer for the Institute of Cellular Medicines & module dissertation leader at Newcastle University), who allowed this paper to be my own work, but steered me in the right direction whenever he thought I needed it. I would also like to thank Prof Liberato Camilleri (Statistician at the University of Malta) and Dr Elizabeth Mallia, to whom I am indebted for their valuable comments with regard to the statistical aspects of this report.

My gratitude also goes to the experts who were involved in the validation survey for this research project: Dr Antoine Vella (Consultant Geriatrician & Visiting Senior Lecturer at the University of Malta) and Dr Jurgen Abela (Specialist in Family Medicine, Malta & Visiting Senior Lecturer at the University of Malta). Their validation input was very valuable and highly appreciated. I would also like to thank Ms Krista Bonnici and Mr Daniel W. Grech who proofread this work.

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Supplementary Table showing Included and Excluded Doctors by Specialty

Included Doctors by Specialty	Excluded Doctors by Specialty
General Practitioners	Paediatricians
Emergency Physicians	Haematologists
Gynaecologists	Occupational Medical Doctors
Orthopaedic surgeons	Microbiologists/bacteriologists
Medical Physicians (including oncologists and palliative care physicians)	Radiologists
	Anaesthetists
	Psychiatrists
	All other surgeons