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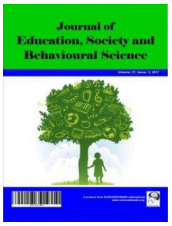

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Knowledge, Attitude and Practices on Handling, Processing and Consumption of Marine Foods in Zanzibar, Tanzania

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Authors' contributions

This was a collaborative work among all authors. Author ARR designed the study, administered and supervised the questionnaire execution in the field, did statistical analysis and wrote the first draft of the manuscript. Authors ARR and SIK designed and fine tuned the questionnaire. Authors SIK, PNW, GM, RHM assisted on study design and in drafting and refining the manuscript. Authors EM and RN modeled the questionnaire for statistical study and collaborated on statistical analysis. Author AM contributed on literature citing, organsing and fine tuning of the manuscript according to journal requirements. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study was carried out with the objective of assessing knowledge, attitudes and practices (KAP) related to marine food associated diseases (MFADs) among fish stakeholders in Zanzibar with socio-demographic characteristics of age, education level, sex, marital status and years of

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primary occupation.
Study Design: A cross sectional study that utilized structured questionnaire was conducted
Place and Duration of Study: The study was carried out in Zanzibar, Tanzania between September 2015 and March 2016.
Methodology: Structured questionnaires were developed and used to collect data from 663 respondents. Each individual KAP variable was divided into 2-3 elements; elements of knowledge were on transmission, epidemiology and symptoms in humans, elements of attitude were on attitude towards threat and towards control and elements of practices were on practices of disease prevention and practices of sharing of information. Mean of the dependant variables were calculated to identify their cut off points that decided the level of the variable under question. Data was then pooled together to obtain overall knowledge, overall attitude and overall practice. Chi-square test was used to determine statistical association among KAP variables.
Results: Overall attitudes, overall knowledge and overall practices were highly associated ($p=0.000$) with age, level of education and primary occupation. Overall practices were associated with years of primary occupation ($p<0.05$). Moreover, years of primary occupation was highly associated with overall knowledge. None of the pooled dependant variables had association with gender or marital status ($p>0.05$). Overall attitudes, overall knowledge and overall practices were all observed to be highly associated ($p=0.000$) with each other.
Conclusion: High association on MFADs was found in this study between KAP with sociodemographic variables. Sociodemographic variables can therefore be predictors of KAP. High association observed among overall KAP variables indicates synergism and interrelation amongst them. Gaps within elements of KAP need to be addressed to improve hygiene and handling of marine foods.

Keywords: Marine foods; overall attitudes; overall knowledge and overall practices; marine food associated diseases (MFADs).

1. INTRODUCTION

Marine animal foods, one of the favorite meals in the coastal part of Tanzania and Zanzibar, are popular as delicacy and their high nutritional value emanating from having low content of saturated fat and richness in proteins, minerals and vitamins. Like any other foods consumed by humans, marine foods are also faced with diverse challenges on handling through the value chain that has an implication on food safety and public health in general. Practices of food handlers including final food preparers at home [1,2] and in restaurants [3,4] can contribute to food contamination and render the food unsafe to consumers.

While the World Health Organization admits that nutritious food is key to sustaining life and promoting good health, it also notes that changes in consumer habits has resulted in increasingly complex and longer global food chain and as the world ‘s population and food demand grows it creates both opportunities and challenges for food safety [5,6]. Food-borne and waterborne diarrheal diseases kill an estimated 2 million people annually, including many children [5].

Over the years, cases of human poisoning from marine derived foods have been reported among Zanzibar fish consumers: at least three incidences of fatal fish food poisoning episodes were reported in Zanzibar between 2005-2010 resulting in 20 deaths and 65 hospitalizations [7]. The reported annual food poisoning cases in Zanzibar in the years 2012, 2013 and 2014 were 590, 479 and 333 respectively [7]. It is quite likely that there are many more unreported cases.

The fish sector in Zanzibar employ around 86,000 full time fishermen and twice that figure are employed by fish sector indirectly [8]. The fish industry contributes 6.1% of the Zanzibar GDP [9]. Moreover, fish foods are consumed by 87% of the Zanzibar population almost daily [10]. The importance of the fishing industry to the Zanzibar economy and nutrition accentuate the need to have basic information on knowledge, attitude and practices of the fish stakeholders.

Given the ever-changing demographic structure and life style in Zanzibar and Tanzania at large as well as the expanding tourist industry, it is imperative that research be done on the prevailing knowledge, attitudes and practices on marine foods. To reduce food borne outbreaks, it is very important to have a clear understanding

of the interaction of the prevailing knowledge, attitudes and practices of food-handlers and consumers [11,12,13]. The aim of this study is to investigate the knowledge attitudes and practices of fish stakeholders- fishermen, traders, and consumers- on handling, processing and consumption of marine products in Zanzibar. Information obtained from these studies shall encourage positive knowledge to stakeholders, improve better practices and boost consumer confidence in marine foods safety.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Zanzibar islands Unguja and Pemba. Zanzibar being part of the United Republic of Tanzania is situated around 42km off the coast of East Africa in the Indian Ocean. Administratively Zanzibar has five regions, 2 in Pemba and 3 in Unguja Island. The islands enjoy a permanently humid weather with long rains in March to May and short rains between October and December and average ambient temperature of 28.5ºC. Samples were drawn from 13 fish landing sites distributed in Unguja and Pemba islands that were chosen from 207 landing sites distributed throughout the islands [8]. Three out of at least 5 villages in each site were randomly chosen for interview. Landing sites were divided into 8 zones; North, South, West and East Zones of Unguja and North, South, West and South of Pemba Island.

2.2 Study Design

A cross sectional study that utilized structured questionnaire was conducted between September 2015 and March 2016.

2.3 Study Population

Responders consisted of fishermen, vendors and fish consumers mostly around the chosen 13 sites. Questionnaires were developed during the study and administered with the assistance of field staff of the Zanzibar Ministry of Livestock and Fisheries. Responders were personally contacted in the field, market places and in their homes. Total number of responders was 663.

2.4 Sampling and Data Types

A conceptual framework was developed to assess on how the dependent variables can be influenced by the socio-demographic independent variables. Individuals who were interviewed comprised of fishermen, fish consumers, vendors and restaurant owners.

Knowledge questions were divided into 21 items that specified on disease transmission, epidemiology and symptoms in humans. Attitude items were 18 divided equally on attitudes towards threat and attitudes towards one's ability to control disease occurrence. Five items were on practices of disease prevention.

Each of the KAP variables was divided into individual elements as seen in Table1 below:

Table 1. Individual elements of KAP

Overall variable	Elements of each KAP variable
Overall knowledge	Transmission Epidemiology Symptoms
Overall practice	Practices on disease prevention Practice on information sharing
Overall attitude	Attitude towards threat Attitude towards disease control

2.5 Sample Size Determination

Sample size was calculated, at 95% confidence interval, using the formulae below where the Z value at 95% confidence interval is 1.96 and the margin of error E is 1 [14]

$$n = \left[\frac{Z_{\alpha/2}\sigma}{E}\right]^2$$

2.6 Data Collection Tools and Processes

2.6.1 Statistical analysis

Levels of individual elements of knowledge were assessed as right or wrong, attitude as positive or negative and practices as good or bad. Right knowledge, positive attitude and good practices were given scores of 2 while wrong knowledge, negative attitude and bad practices scored 1. Scores of individual independent elements were then summed up and their mean calculated for deciding the cut off points and indices of overall knowledge, overall attitude and overall practices

(Table 2). Scores were used to calculate chi-square and p-*values* and therefore the association of variables of interest. Data was processed by SPSS version 6.0. Statistical significance was determined at a probability of $p \leq 0.05$.

Table 2. Indexing of dependent variables

Dependent variable	Mean score	Index
Overall knowledge	< 4.83	Low
	= 4.83	Medium
	> 4.83	High
Overall practice	< 5.11	Poor
	= 5.11	Average
	>5.11	High
Overall attitude	≥ 7.56	Positive
	< 7.56	Negative

2.7 Questionnaire Validity and Reliability

The validity and reliability of the questionnaire was evaluated in the pilot study that involved 20 responders. Cronbach's alpha was calculated to assess the reliability: 0.804 for knowledge items, 0.755 for attitude items and 0.646 for items that assessed practices.

2.8 Statistical Analysis

The data for KAP were subjected to analysis using statistical package for social sciences (SPSS) version 6.0, where Chi-square test was used to determine statistical association.

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Socio-demographic characteristics

Total of 663 participants responded to the survey questionnaire; 364 from Unguja and 299 from Pemba, 496 were males and 167 females (Table 3). Farming, fishing and trading employed 26.2%, 27.3% and 36.5% of participants respectively. Fishing was dominated by males (78.6%). Majority of responders were married (85%), the rest were either widowed or unmarried. Most of responders were between 38 and 47 years of age (36%) while the minimum ages of 17-27 were the minority (9%) (Table 3). More than half of responders had achieved at least Primary level of education. Informally educated responders (those who can read Arabic alphabets only) constitute 5% of responders. University graduates constitute 1% of responders (Table 3).

3.1.2 Knowledge on transmission

Significant association was observed on age group ($p<0.05$); the age group 38-47 (92.9%) had higher knowledge than the rest. Marital status, level of education and years of primary occupation were highly associated with knowledge on transmission ($p<0.001$). Married, those with primary education and above and responders who were in primary occupation for more than 10 years had more knowledge on transmission.

3.1.3 Knowledge on epidemiology

Highly significance association on knowledge on epidemiology was observed across the education levels ($p<0.01$); those with at least primary education had higher knowledge on epidemiology than illiterate or informally educated. Highly significance association was observed on primary occupation ($p<0.000$), traders followed by fishermen had more knowledge on epidemiology.

3.1.4 Knowledge on symptoms

Highly significant association on knowledge of symptoms ($p<0.001$) was observed among education levels and primary occupation. Responders with at least primary education and fishermen and traders were more knowledgeable on symptoms. Also, significant association ($p<0.05$) was observed between marital status and knowledge on symptoms; married more knowledgeable than unmarried o widowed.

3.1.5 Attitude towards threat

Majority of responders, irrespective of the sociodemographic bearing, had positive attitude that MFADs could be a threat to oneself and wellbeing of their communities. However, level of education was the only variable that yielded statistical significant association ($p<0.01$). This means that, a person's altitude depends on his or her level of education.

3.1.6 Attitude towards one's ability to control

Attitude towards ability to control MFADs were positive throughout the sociodemographic variables. Moreover, statistical association was observed in age ($p<0.05$) groups and primary

occupation only (*p=0.000*). This means that, a person's altitude towards one's ability to control depends on which age group that person belongs to, as well as his or her primary occupation. The young age group (18-27yrs) scored higher (91.7%) on attitude towards control than older age groups.

3.1.7 Practices on disease prevention

Significant statistical association on prevention practices were observed among education and primary occupation groups (*p<0.01*). Secondary education and University education groups scored highest on prevention practices.

3.1.8 Practices on information sharing

Men are more inclined to share information on MFADs than women and so are married than non-married. The oldest age group >47 had lowest percentage on practice of information sharing. Illiterate and informal educated are less likely to share information compared to formally educated colleagues. All primary occupations and all years of primary occupations except the young age group (18-27yrs) have good practices of information sharing.

Statistical association on practice of information sharing (*p<0.05*) was observed with level of education. Responders with at least primary education are more likely to share information.

3.1.9 Overall knowledge

Most of responders have high knowledge on MFADs. However young age group (18-27yrs), illiterate, farmers and those who worked on their primary occupation for less than 5yrs had relatively poor knowledge on MFADs (Table 4). High association (*p*<0.000) was observed between overall knowledge and all sociodemographic variables except gender and marital status (Table 4).

3.1.10 Overall attitudes

Generally, attitudes towards MFADs control and prevention are positive across all sociodemographic characteristics. Moreover, high statistical association (*p*<0.000) was observed on age groups, education levels and primary occupation (Table 5). Age group 38-47yrs had best attitude and the young (17-28yrs) had low attitude, the higher the education the higher the attitude. Additionally, employees had best positive attitude.

3.1.11 Overall practices

The young (18-27yrs) age group, illiterate, farmers and those with primary occupation for less than 5 years didn't have higher scores on good practices. The rest of the sociodemographic groups scored high on good practices. Responders with higher level of

Table 3. Socio-demographic characteristics of questionnaire participants

Characteristics		Frequency
Gender	Male	496(74.9) *
	Female	167(24.1)
	Total	**663(100) ****
Age (Years)	18-27	58(9)
	28-37	180(28)
	38-47	222(36)
	Above 48	178(28)
	Total	**638(100) ****
Level of education	Illiterate	119(18)
	Informal	33(5)
	Primary school	205(31)
	Secondary school	271(41)
	Diploma	19(3)
	University	8(1)
	Total	**655(100) ****
Marital status	Married	547(85)
	Unmarried	42(6)
	Widowed	56(9)
	Total	**645(100) ****

**figures in parentheses are percentages, ** Total number of responders*

Table 4. The overall knowledge of respondents

Characteristic		Overall knowledge			Chi square (P-value)
		Low (%)	Medium (%)	High (%)	
Sex	Male	199 (40.1)	39 (7.9)	258 (52.0)	0.292 (0.864)
	Female	68 (40.7)	11 (6.6)	88 (52.7)	
Marital status	Married	217 (40.2)	43 (8.0)	280 (51.8)	4.986 (0.288)
	Unmarried	21 (42.0)	6 (12.0)	23 (46.0)	
	Widowed	19 (32.2)	9 (15.3)	31 (52.5)	
Age group	18-27	36 (53.7)	8 (11.9)	23 (34.4)	23.058 (0.000***)
	28-37	74 (42.0)	9 (5.1)	93 (52.9)	
	38-47	56 (29.6)	17 (9.0)	116 (61.4)	
	>47	100 (45.9)	11 (5.0)	107 (49.1)	
Education level	Illiterate	79 (65.8)	8 (6.7)	33 (27.5)	261.752 (0.000***)
	Informal	81 (38.9)	20 (9.6)	107 (51.5)	
	Primary	72 (37.3)	16 (8.3)	105 (54.4)	
	Secondary	6 (15.8)	20 (52.6)	12 (31.6)	
	Diploma	1 (2.1)	41 (87.2)	5 (10.7)	
Primary occupation	Farmer	100 (57.5)	12 (6.9)	62 (35.6)	34.557 (0.000***)
	Fishermen	61 (33.7)	12 (6.6)	108 (59.7)	
	Employee	16 (23.9)	7 (10.5)	44 (65.6)	
	Trader	90 (37.3)	20 (8.3)	131 (54.4)	
Years in primary occupation	<2	7 (20.6)	11 (32.4)	16 (47.0)	66.869 (0.000***)
	2-5	25 (34.7)	26 (36.1)	21 (29.2)	
	6-5	53 (43.4)	6 (5.0)	63 (51.6)	
	>10	20 (34.5)	29 (8.3)	199 (57.2)	

**=p<0.05, **=p<0.01, ***=p=0.000*

Table 5. Overall attitude of respondents

Characteristic		Overall attitude		Chi square (P-value)
		Positive attitude (%)	Negative attitude (%)	
Sex	Male	355 (74.4)	122 (25.6)	0.979 (0.323)
	Female	123 (78.3)	34 (21.7)	
Marital status	Married	391 (75.3)	128 (24.7)	0.433 (0.805)
	Unmarried	33 (71.7)	13 (28.3)	
	Widowed	40 (72.7)	15 (27.3)	
Age group	18-27	40 (62.5)	24 (37.5)	19.025 (0.000***)
	28-37	132 (80.0)	33 (20.0)	
	38-47	154 (82.8)	32 (17.2)	
	>47	140 (68.0)	66 (32.0)	
Education level	Illiterate	56 (50.5)	55 (49.5)	53.524 (0.000***)
	Informal	150 (76.3)	47 (23.7)	
	Primary	206 (81.1)	48 (18.9)	
	Secondary	23 (88.5)	3 (11.5)	
	Diploma	12 (92.3)	1 (7.7)	
	University	29 (96.7)	1 (3.3)	
Primary occupation	Farmer	107 (62.2)	65 (37.8)	28.456 (0.000***)
	Fishermen	138 (78.0)	39 (22.0)	
	Employee	56 (93.3)	4 (6.7)	
	Trader	177 (78.7)	48 (21.3)	
Years in primary occupation	<2	12 (70.6)	5 (29.4)	3.991 (0.262)
	2-5	30 (62.5)	18 (37.5)	
	6-5	86 (73.5)	31 (26.5)	
	>10	272 (75.8)	87 (24.2)	

**=p<0.05, **=p<0.01, ***= p=0.000*

education scored high on good practices. Highly significant association (p=0.000) was observed between overall practices and age group, level of education and primary occupation (Table 6). Association was also found between overall practices and years of primary occupation (p<0.05).

3.1.12 Association among knowledge, attitude and practices (KAP) variables

High statistical association (p=*0.000*) was observed among dependent KAP variables of overall knowledge, overall attitudes and overall practices (Tables 7, 8 and 9).

Table 6. Overall practices of respondents

Characteristic		Overall practice			Chi square (P-value)
		Poor practice (%)	Average practice (%)	Good practice (%)	
Sex	Male	141 (28.4)	91 (18.3)	264 (53.2)	5.346 (0.06)
	Female	62 (37.1)	22 (13.2)	83 (49.7)	
Marital status	Married	172 (31.5)	87 (15.9)	287 (52.6)	3.401 (0.493)
	Unmarried	15 (31.9)	11 (23.4)	21 (44.7)	
	Widowed	14 (25.0)	12 (21.4)	30 (53.6)	
Age group	18-27	23 (35.4)	19 (29.2)	23 (35.4)	26.282 (0.000***)
	28-37	42 (23.6)	39 (21.9)	97 (54.5)	
	38-47	53 (28.0)	21 (11.1)	115 (60.9)	
	>47	81 (37.2)	34 (15.6)	103 (47.2)	
Education level	Illiterate	46 (38.3)	41 (34.2)	33 (27.5)	67.136 (0.000***)
	Informal	70 (33.7)	35 (16.8)	103 (49.5)	
	Primary	68 (26.7)	26 (10.2)	161 (63.1)	
	Secondary	6 (24.0)	3 (12.0)	16 (64.0)	
	Diploma	2 (11.1)	1 (5.6)	15 (83.3)	
	University	4 (11.8)	5 (14.7)	25 (73.5)	
Primary occupation	Farmer	90 (51.7)	23(13.2)	61 (35.1)	58.178 (0.000***)
	Fishermen	39 (21.5)	26 (14.4)	216 (64.1)	
	Employee	13 (19.7)	10 (15.2)	43 (65.2)	
	Trader	61 (25.2)	54 (22.3)	127 (52.5)	
Years in primary occupation	<2	9 (39.1)	5 (21.8)	9 (39.1)	14.588 (0.02*)
	2-5	18 (35.3)	16 (31.4)	17 (33.3)	
	6-5	39 (32.0)	22 (18.0)	61 (50.0)	
	>10	104 (28.8)	53 (14.7)	204 (56.5)	

**=p<0.05, **=p<0.01, ***= p=0.000*

Table 7. Association between overall knowledge and overall attitude

Overall attitude	Overall knowledge			Chi-square *p*-value	
	Low	Medium	High		
Negative attitude	151 (96.8)	4 (2.6)	1 (0.6)	311.2	0.000***
Positive attitude	87 (18.2)	46 (9.6)	345 (72.2)		

**=p<0.05, **=p<0.01, ***= p=0.000*

Table 8. Association between overall practice and overall knowledge

Overall knowledge	Overall practice			Chi-square *p*-value	
	Poor	Average	Good		
Low	174 (65.2)	73 (27.3)	20 (7.5)	407.3	0.000***
Medium	19 (38.0)	8 (16.0)	23 (46.0)		
High	10 (2.9)	32 (9.2)	304 (87.9)		

**=p<0.05, **=p<0.01, *** p=0.000*

Table 9. Association between overall practice and overall attitude

Overall attitude	Overall practice			Chi-square *p*-value	
	Poor	Average	Good		
Negative attitude	111 (71.2)	42 (26.9)	3 (1.9)	233.9	0.000***
Positive attitude	91 (19.0)	43 (9.0)	344 (72.0)		

**=p<0.05, **=p<0.01, ***= p=0.000*

3.2 Discussion

This study clearly demonstrates relationship between knowledge, attitudes and practices (KAP) with sociodemographic variables with reference to Marine food associated diseases (MFADs) among Zanzibaris. Level of education, age and duration of primary occupation were sociodemographic variables that were most of the times found to affect KAP variables while gender and marital status yielded variable results. Previous work also established relationship between KAP variables and sociodemographic characteristics [15,16,17] but results of this study contrast with other findings which didn't find correlations between some of KAP variables [18,19,20]. The association observed in this study could be attributed to synergism observed between the KAP variables.

A consistent association was observed in this study between education and knowledge elements of transmission, epidemiology and symptoms, the more someone is educated the better knowledge he/she has on MFADs. Association between knowledge and education agree with other studies [21,22,23,24]. However, other workers didn't find association between education and knowledge or practices [25,26]. Education is the process of facilitating learning, or the acquisition of knowledge, skills and habits [27]. The study results illustrate that level of education is a predictive factor for knowledge on MFADs. Indeed, low education is often associated with risk of diseases [28] and may also affect help seeking behavior and disease control [29]. This study confirms that to achieve higher knowledge on MFADs frequent education trainings must be conducted among fish stakeholders that also have positive impact on boosting preventive practices. However, it is cautioned by Adesokan et al. [30] that for knowledge to have positive impact on practices short refresher trainings of not more than two weeks should be conducted to food stakeholders.

It is generally expected that with increase in age one is supposed to be more knowledgeable which is true with this study with overall knowledge; nevertheless, knowledge on transmission was the only knowledge element that had significant association with age in this study. It was also observed that young responders (17-28 yrs) always scored low on knowledge compared with older colleagues. These results agree with the work of Jackey et al. [31], Arbiol et al. [32] and Rahman et al. [33] who reported a significant association between KAP variables with age.

Occupation, according to previous studies, can affect KAP variables [22]. All occupations in this study displayed reasonable knowledge on MFADs. Of the four types of occupations investigated in this study farmers, in most of the cases, had lowest knowledge on MFADs. Fishermen expressed high knowledge on transmission, epidemiology and symptoms; traders were most knowledgeable on transmission while employees were most conversant with symptoms. Primary occupation had significantly high association with overall KAP variables. These results are not surprising because all primary occupations under investigation were fish stakeholders. However, results of the present study revealed that primary occupation didn't exert any significant impact on knowledge on symptoms and attitudes and didn't influence the information sharing practices.

A general trend was observed with duration of primary occupation, the more the years on work with fish sector the more knowledgeable one becomes on MFADs; statistical association was observed on overall knowledge *(p=0.000)* and practices with years of primary occupation. Similar observation was reported by Jackey et al. [31] and Labib et al. [22]. No significant association was observed between years of primary occupation and knowledge on epidemiology and symptoms hence the need for mitigation measures to fill this gap.

Both attitudes towards threat and one's ability to control MFADs were positive in this study; results indicate more than 75% of responders had positive attitudes. Overall attitudes were significantly associated with age, level of

education and primary occupation; yet statistical significance was only observed on level of education with attitude towards threat ($p<0.01$) and age ($p<0.05$) and primary occupation with attitude towards ability to control MFADs.

Attitude was also found to be highly associated with knowledge and practices. It is emphasized that positive attitudes are a prerequisite and need to be complemented with knowledge to be interpreted into preventive practices [32,34]; knowledge and attitudes are therefore predictors of good practices as observed by Kassahun and Mekonen [35]. Nevertheless, Lin and colleagues [17] noted that attitudes have stronger association with practice than knowledge.

The overall practices, in this study, were highly associated ($p<0.000$) with age, level of education and primary occupation and its duration and therefore these sociodemographic variables could be predictors of practices, an observation that agree with findings of Arbiol et al. [32]. Practices were also highly associated with attitudes and knowledge; here again statistical significance was observed between prevention practices and level of education and primary occupation ($p<0.05$) and practice of information sharing and level of education ($p<0.05$). Results were in consistence which what was found by Jackey et al. [31] and Afolaranmi et al. [20]. On the contrary, other studies found that knowledge is not always interpreted into practice [21,36,37,38]. Moreover, the practice of information sharing in communities is very important in raising education and knowledge and for rapid disaster response [11].

High association of KAP variables demonstrated in this study substantiates findings of Arbiol et al. [32] that these variables are synergistic and knowledge and attitudes are important predictors of preventive practices.

Observations made in this study proved there is significant association of KAP with sociodemographic variables as far as marine associated diseases among Zanzibaris is concerned. Nevertheless, even if overall KAP variables interrelate, there were no significant associations with individual elements of KAP variables with some sociodemographic variables. These gaps need to be addressed by responsible authorities; there must be direct engagement and collaboration between stakeholder Ministries and Departments-Education, Health, Municipality, Regional Administration and local communities to improve attitude, education and positive health behaviors on handling and processing marine foods.

4. CONCLUSION

High association on MFADs was found in this study between KAP variables with sociodemographic variables especially age, education, primary occupation and years of occupation. These sociodemographic variables can therefore be predictors of KAP. Moreover, high association observed among overall KAP variables indicates synergism and interrelation amongst them. However, even though associations were established among KAP variables and sociodemographic variables, with collaboration from relevant Ministries and Departments, gaps within elements of KAP need to be addressed to improve hygiene and handling of marine foods.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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