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Knowledge, practices and intention to consume omega 3 and omega 6 fatty acids among pregnant and breastfeeding women in Morogoro Municipality, Tanzania

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Omega 3 and omega 6 fatty acids are beneficial throughout the human life cycle. With regard to early child development, maternal fatty acid status influence cognitive and psychomotor development of the unborn child. Regardless of their importance in early childhood development they still receive less attention when compared to other nutrients. This paper aimed to assess knowledge, practices and intention to consume omega 3 and omega 6 fatty acids among pregnant and breastfeeding women in Morogoro Municipality and the study adopted the Theory of Planned Behavior (TPB). A cross-sectional survey which involved 318 randomly selected pregnant and breastfeeding women was conducted in three wards of Morogoro Municipality. Data were collected through face to face interview using a questionnaire. Statistical Package for Social Sciences (SPSS) version 20 was used for data analysis. Knowledge, Attitude and Practices (KAP) Scores were compared with demographic characteristics by Analysis of variance (ANOVA) with the level of significance set at $p<0.05$. The findings revealed limited knowledge on omega 3 and omega 6 fatty acids. However most of the participants showed positive attitude towards omega 3 and omega 6 fatty acid food sources and they intended to use them in the future if they are properly trained. Level of education had a significant influence on respondents' knowledge ($p = 0.003$) and attitudes ($p = 0.004$). It was concluded that, any attempt to increase consumption of omega 3 and omega 6 fatty acids among pregnant and breastfeeding women in Tanzania have to pay attention on their knowledge, attitudes and beliefs.

Key words: Omega 3 and omega 6 fatty acids, knowledge, attitude, intention, pregnant women, breastfeeding women.

INTRODUCTION

Fats in the diet mainly consist of triglyceride, a molecule composed of three fatty acids and a glycerol backbone (Mensink, 2016). Fatty acids (FA) consist of) carbon, hydrogen and oxygen, arranged as a linear carbon chain

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skeleton of variable lengths (Astrup, 2019). Depending on their degree of saturation/unsaturation in the carbon chain, they can be classified as saturated (no double bond), monounsaturated (one double bond) and polyunsaturated (two or more double bonds) fatty acids (Lund and Rustan, 2020).

Polyunsaturated fatty acids are very important for various metabolic processes that influence health and well-being (Forsyth et al., 2016). For example, the omega 3 polyunsaturated fatty acids such as docosahexaenoic acid (DHA) and alpha linolenic acid (ALA) are important for proper fetal development and they also influence cellular structure and function, brain development, neuronal, retinal and immune function of unborn babies (Kim et al., 2017). Omega 6 polyunsaturated fatty acids such as arachidonic acid (ARA), are also important for proper functioning of the central nervous system as well as regulation of various biological processes, particularly those related to cerebral, cardiovascular and immune functions (Calder, 2015).

Omega 3 and omega 6 fatty acids are called essential fatty acids and this is because they are not synthesized by the body and therefore, they must be obtained through diet or supplementation (Rocha et al., 2021). Dietary sources of long chain omega 3 fatty acids such as eicosapentaenoic acid (C20:5n-3) and docosahexaenoic acid (C22:6n-3) and omega 6 fatty acids such as arachidonic acid (C20:4n-6) include salmon, sardines, sword fish, tuna, shark and trout (Maurya et al., 2018). They can also be synthesized from alpha-linolenic acid found in vegetable oils, nuts and seeds such as flaxseeds and chia seeds (Maslova et al., 2018).

With regard to early child development, maternal fatty acid status particularly docosahexaenoic acid (DHA) helps in the development of the brain and retina of the unborn baby (Huffman et al., 2011). It can also influence the cognitive and psychomotor development of infants (Händel et al., 2021). Therefore maternal polyunsaturated fatty acid status plays an important role in early child development and it is important to ensure that women of reproductive age maintain a good polyunsaturated fatty acids (PUFAs) status prior, during and after conception (Stark et al., 2016).

In many developing countries, problems associated with inadequate intake of omega 3 and omega 6 fatty acids among pregnant and breastfeeding women have received little attention so far despite their potential major implications in terms early child development (Derbyshire, 2018). Several studies conducted in different areas have revealed positive association between maternal inadequate intake of omega 3 and omega 6 and attention deficiency hyperactive disorder (ADHD) (Händel et al., 2021), poor brain development (Shahidi and Ambigaipalan, 2018), gastrointestinal disorders (Mogensen, 2017), cardiovascular problems (Bird et al., 2018) as well as visual problems in infants (Shulkin et al., 2018). The study conducted by Jumbe et al. (2016) in Tanzania revealed a positive relationship between polyunsaturated fatty acid status and cognition, growth and executive function in children. Despite this developmental association which starts as soon as a mother conceives, it has been difficult to target this period because most of the mothers starts their first antenatal care visits in their second trimester (TDHS-MIS, 2016; WHO, 2016). In addition, provision of omega 3 and omega 6 fatty acids through supplements has been very expensive and questionable in terms of sustainability especially in developing countries.

In Tanzania, studies reporting knowledge, practices and intention to consume omega 3 and omega 6 fatty acid foods among pregnant and breastfeeding women are limited. Most of the previous studies have been focusing on micronutrient malnutrition such as those related to iron, zinc, iodine and vitamin A deficiency (Kinabo et al., 2019; Watts et al., 2019; Robert et al., 2021).

Therefore the findings from this study will be used by various food and nutrition stakeholders in Tanzania to initiate efforts to improve the nutritional status of pregnant and breastfeeding women and children. The overall objective of the study was to assess knowledge, practices and intention to consume omega 3 and omega 6 fatty acids among pregnant and breastfeeding women in Morogoro Municipality, Tanzania.

METHODOLOGY

Study design and setting

This study was cross sectional and it was conducted at Morogoro Municipality located in Morogoro region, Tanzania from May to June, 2021. Morogoro region lies between latitude 5º 58'' and 10º 0'' South of the Equator and longitude 35º 25'' and 35º 30'' East. The projected population size of Morogoro Municipality as of the year 2020/2021 is 409,565 (MMC, 2021). Administratively, Morogoro Municipality is composed of 25 wards. The most populated ward is Chamwino (n=35,699) and the least populated ward is Mzinga (n=1,748). Major economic activities include trade (wholesale, retail, food vending and petty trade), industrial activities as well as transport and communication. Food crops found in the area includes maize, beans, paddy, cassava, sorghum, potatoes and different types of fruits and vegetables (Kangile et al., 2020).

Sample size and sampling

The sample size was calculated based on the number of women aged between 15-49 years (63 807) since they are termed as women of reproductive age. Using 5% precision at 95% confidence level and 10% non-response rate, the obtained sample size was 318 respondents. Using Morogoro Municipal administrative structure, multistage cluster sampling was used to obtain the least administrative units which are the wards. Three out of the 25 wards were selected randomly and then with the assistance of the local leaders, the households were randomly selected based on the inclusion and exclusion criteria. Pregnant and breastfeeding women from three wards namely Mafiga, Kihonda and Mazimbu were involved in the study.

Inclusion and exclusion criteria

Pregnant and breastfeeding women who were aged between 18-49 years, have stayed in the study area for at least six months and were able to provide an informed consent were eligible to participate in the study. Pregnant or breastfeeding women who had special medical conditions, mentally ill and those who had not confirmed their pregnancy at the hospital were excluded from the study.

Data collection

Data collection was done through face to face interview using a questionnaire. The questionnaire was formulated through review of published literature to suit the research needs and then it was validated based on the comments of the nutrition experts. The Questionnaire was pretested in a randomly selected sample of 10 individuals who were not included in the study but had similar characteristics to the study sample. It was then corrected to avoid misleading information, ambiguous sentences and repeated questions.

The first part of the questionnaire inquired information regarding socio-demographic characteristics of the study participants such as age, education level, occupation, marital status and whether they were pregnant or breastfeeding. The second and third part of the questionnaire inquired information about participant's knowledge, practices and intention to consume omega 3 and omega 6 fatty acid foods sources.

There were 15 questions for assessing knowledge and 10 statements for assessing practices. The questions were administered in Kiswahili language and the terminologies such as saturated and unsaturated fatty acids were described in way that the respondents would understand what we were talking about. Also omega 3 and omega 6 terminologies were replaced by their food sources or metabolic functions. For example to know the sources of omega 3, the respondents were asked if they knew the foods that are important for brain development and if the answer was 'yes', then they were asked to mention them.

There were also 7 statements for measuring attitudes of the participants towards omega 3 and omega 6 fatty acids food sources with follow-up questions. The respondents were asked whether they 'agreed', 'neither agreed nor disagreed' or 'disagreed' with the statements. The last 16 questions measured participant's normative beliefs, control beliefs and general intention to consume omega 3 and omega 6 fatty acid rich foods.

In order to assess the socio demographic determinants of knowledge, attitude and practices; all the correct statements were scored as 'one' and the incorrect ones as 'zero' and then they were summed up independently. The total score for each respondent was calculated as (score/total score x 100). For example if a person scored 10 in knowledge assessment and the total number of questions were 15, then her score would be (10/15 x 100) = 66.7 which is approximately 67%.

Statistical analysis

Data were subjected to the descriptive analysis using the computer software Statistical Products and Service Solution (SPSS) version 20.0 after being cleaned. All the categorical variables were presented as frequencies and percentages and all the continuous variables were shown as Mean ± Standard Deviation. Cross tabulation and chi-square tests were used to determine associations. To compare knowledge, attitude and practice scores with social demographic characteristics, Analysis of Variance (ANOVA) were used. Turkeys HSD test was used was used for multiple mean comparison tests. Statistical significance was set at $p<0.05$.

Ethical considerations

The study protocol was approved by Sokoine University of Agriculture, Morogoro Regional Administrative Secretary, Morogoro District Administrative Secretary, Morogoro Municipal Council Director and Ward Executive Officers from Mafiga, Kihonda and Mazimbu. Also written informed consent was obtained from all the participants who took part in this study. All the participants were ensured of confidentiality and autonomy, the information obtained will not be misused and the outcomes of the research will be shared with them.

RESULTS

Social and demographic characteristics of the study participants

The age-range of the respondents was 18-44 years, with mean of 28.7 (SD 6.2). About half of the study subjects had primary school education and 42.8% (n=159) were home makers. In terms of marital status, most of them (42.1%, n=136) were married and majority (65.5%, n=173) had one or two children. About 32% (n=101) of all the study subjects were pregnant at the time of data collection and 43.2% (n=41) of those who were pregnant were in their second trimester (Table 1).

Knowledge regarding omega 3 and omega 6 fatty acid

Table 2 summarizes information about respondents' knowledge regarding omega 3 and omega 6 fatty acids. About half of the study participants (53.0%) were not able to differentiate between fat and oil. Most of them (63.5%) were able to correctly identify the sources of lipids. Only few (28.9%) heard about saturated and unsaturated fatty acids. Majority of the study participants could not correctly identify sources of saturated and unsaturated fatty acids. Only 20% of the participants had ever heard about omega 3 and omega 6 fatty acids. Respondents sought information regarding omega 3 and omega 6 fatty acids from a range of sources and some of them included school/college (37.5%), nutrition seminars, internet and media (31.2%). Majority of those who heard about omega 3 (92.2%, n=59) and omega 6 (95.3, n = 61) fatty acids couldn't correctly identify their sources. Most of them didn't know the benefits of omega 3 and omega 6 fatty acids prior to conception and to unborn baby (82.2%) or to the pregnant mother's body (71.9%). Only 18.8% knew the diseases that can be prevented by consuming foods rich in omega 3 and omega 6 fatty acids.

Practices regarding omega 3 and omega 6 fatty acids

Majority of the participants (97.5%) preferred plants as

Table 1. Socio-demographic characteristics of the study participants.

Variable	Frequency	Percent
Mean age 28.7±6.17		
Age (years)		
18-24	107	33.6
25-34	148	46.5
>35	63	19.8
Education level		
Never been to school	23	7.2
Primary school	159	50.0
Secondary school	90	28.3
Higher education	46	14.5
Occupation		
Home maker	136	42.8
Employed in a formal/informal sector	94	29.6
Self-employed	88	27.7
Marital status		
Never been married	97	30.5
Married	134	42.1
Separated/Divorced	21	6.6
Widowed	7	2.2
Living together	59	18.6
Have children		
Yes	262	82.4
No	56	17.6
Number of children		
1-2	172	65.6
3-4	75	28.7
5-6	12	4.6
>6	3	1.1
Pregnant		
Yes	101	31.8
No	217	68.2
Gestational age (trimesters)		
1st trimester	33	32.7
2nd trimester	41	40.6
3rd trimester	21	20.8
Doesn't know	6	5.9

their source of cooking oil and the main reason was the availability of the oils (45.7). Only half (50.0%) of the study participants used specific measurements for cooking oil. Only 37.4% of the subjects declared to have used supplements prior and during pregnancy and the frequently used supplements were iron and folic acid tablets (FEFO) (75.8%) and pregnancy care (15.0%) (Table 3).

Intention to consume omega 3 and omega 6 fatty acid food sources

Behavioural beliefs/attitudes

To determine behavioural beliefs, the study paid attention on what pregnant and breastfeeding women believed to be good for their health and that of their unborn and living babies. 58% of respondents agreed that consumption of omega 3 and omega 6 fatty acid rich foods prior and during pregnancy may result into having a healthy baby(s). Also 58.2% agreed that omega 3 and omega 6 fatty acid rich foods are good for their health and some of them (31.8%) believed that omega 3 and omega 6 fatty acid rich foods are good for weight management. Only few of the respondents (13.8%) had ever tasted fish oil itself or any food that has been made by fish oil. For those who have ever tasted it, most of them (52.3%) liked it. The main reasons for liking fish were good taste (67.9%), medicinal (21.4%), clear and doesn't clot (3.6%). The reasons given by those who disliked fish oil were being nauseous (23.5%), strong smell (70.0%) and bad taste (5.9%). Majority of the respondents (67.0%) didn't know whether consumption of fish oil during pregnancy was safe of not and their main concern was the presence of chemicals (53.3%). The reasons given by those who thought that fish oil was safe during pregnancy were being natural (23.1%), strengthening the body (14.3%), building the body (9.9%), growth of the baby (31.9%) and improving baby's intelligence quotient (17.6%) (Table 4).

Normative beliefs

Based on the results shown in Table 5, majority of the participants (57.9%) agreed that their close friends and family members thinks that they should consume healthy oils, expect them to consume healthy oils (53.8%) or advise them to consume healthy oils (46.7%). Also most of them (73.0%) agreed that their close friends and family members probably consume omega 3 and omega 6 fatty acids food sources especially from plants. Moreover 63.5% agreed that people who are in the same situation as the respondents (such as pregnant and breastfeeding women) probably consumes omega 3 and omega 6 fatty acids food sources.

Control beliefs

Based on the results from this study (Table 6), majority of the study participants (75.2%) agreed that they have

Table 2. Participants' knowledge on omega 3 and omega 6 fatty acids.

Knowledge	Mafiga n (%)	Kihonda n (%)	Mazimbu n (%)	Total n (%)	P-Value
Differentiate fats and oils					
Yes	44 (13.9)	56(17.7)	49(15.5)	149(47.0)	0.598
No	42 (13.2)	71 (22.4)	55 (17.4)	169(53.0)	
Know lipid sources					
Yes	66(20.8)	74(23.3)	62(19.5)	202(63.5)	0.011
No	20(6.3)	54(17.0)	42(13.2)	116(36.5)	
Heard saturated and unsaturated FA					
Yes	39(11.9)	29(9.1)	26(7.9)	94(28.9)	0.001
No	48(15.1)	99(31.1)	79(24.8)	226(71.1)	
Know sources of SFA					
Yes	14(14.9)	5(5.3)	6(6.4)	25(26.6)	0.468
No	25(26.6)	23(24.5)	21(22.3)	69(73.4)	
Know sources of UNSFA					
Yes	17(18.1)	6(6.4)	8(8.5)	31(33.0)	0.377
No	22(23.3)	21(23.4)	19(20.2)	63(67.0)	
Heard omega 3 and omega 6					
Yes	15(4.7)	27(8.5)	22(6.9)	64(20.1)	0.768
No	71(22.3)	101(31.8)	82(25.8)	254(79.9)	
Where heard about omega 3 and 6					
School	4(6.2)	12(18.8)	8(12.5)	24(37.5)	0.379
Hospital	4(6.2)	4(6.2)	4(6.2)	12(18.8)	
Parents/friends	3 (4.7)	3 (4.7)	2(3.1)	8(12.5)	
Seminars internet and media	4(6.2)	8(12.5)	8(12.5)	20(31.2)	
Know sources of omega 3					
Yes	2(3.1)	1(1.6)	2(3.1)	5(7.8)	0.631
No	13(20..4)	26(40.6)	20(31.3)	59(92.2)	
Know sources of omega 6					
Yes	0(0.0)	2(3.1)	1(1.6)	3(4.7)	0.714
No	15(23.4)	25(39.0)	21(32.8)	61(95.3)	
General benefits of EFA					
Yes	5(7.8)	6(9.4)	7(10.9)	18(28.1)	0.579
No	10(15.6)	21(32.8)	15(23.5)	46(71.9)	
Benefits of EFA prior to conception					
Yes	2(3.2)	4(6.5)	5(8.1)	11(17.8)	0.633
No	11(17.7)	23(37.1)	17(27.4)	51(82.2)	
Benefits of EFA to unborn baby					
Yes	2(3.1)	5(7.8)	4(6.2)	11(17.2)	0.703
No	13(20.1)	22(34.4)	18(28.2)	53(82.8)	
Disorders prevented by omega EFA					
Yes	4(6.2)	4(6.2)	4(6.2)	12(18.8)	0.586
No	11(17.2)	23(35.9)	18(28.2)	52(81.2)	

FA-Fatty Acid; SFA-Saturated Fatty Acids; UNSFA-Unsaturated Fatty Acids; EFA-Essential fatty acids.

Table 3. Practices on omega 3 and omega 6 fatty acids.

Practice	Mafiga n (%)	Kihonda n (%)	Mazimbu n (%)	Total n (%)	P-Value
Consider fat content in foods					
Yes	59(18.9)	79(24.8)	71(22.3)	209(65.7)	0.466
No	27(8.5)	49(15.4)	33(10.4)	109(34.3)	
Consider the type of fat to consume					
Yes	48(15.1)	72(22.6)	65(20.4)	185(58.2)	0.551
No	38(11.9)	56(17.6)	39(12.3)	133(41.8)	
Preferred lipid source					
Plant	82(25.8)	125(39.3)	103(32.4)	310(97.5)	
Animals	2(0.6)	2(0.6)	1(0.3)	5(1.6)	0.495
Fish	2(0.6)	1(0.3)	0(0.0)	3(0.9)	
Reasons for preference					
Availability	41(12.9)	57(18.0)	47(14.8)	145(45.7)	
Low price	12(3.8)	20(6.3)	21(6.6)	53(16.7)	
Good taste	6(1.9)	9(2.8)	4(1.3)	19(6.0)	
Good aroma	6(1.9)	12(3.8)	4(1.3)	22(6.9)	
Prevent diseases	4(1.3)	5(1.6)	2(0.6)	11(3.5)	0.169
Clear/refined	5(1.6)	5(1.6)	10(3.2)	20(6.3)	
Natural/fresh	7(2.2)	16(5.0)	14(4.4)	37(11.7)	
Healthy	4(1.3)	0(0.0)	0(0.0)	4(1.3)	
Low cholesterol	1(0.3)	4(1.3)	1(0.3)	6(1.9)	
Specific measurement for cooking oil					
Yes	45(14.2)	69(27.1)	45(14.2)	159(50.0)	0.240
No	41(12.6)	59(18.6)	59(18.8)	159(50.0)	
Use of margarine					
Yes	44(13.8)	64(20.1)	41(12.9)	149(46.9)	0.178
No	42(13.2)	64(20.1)	63(19.8)	169(53.1)	
Consume EFA sources prior to conceive					
Yes	26(8.2)	44(13.9)	27(8.5)	97(30.6)	0.361
No	60(18.9)	83(26.2)	77(24.3)	220(69.4)	
Consume fish oil					
Yes	13(4.1)	16(5.0)	12(3.8)	41(12.9)	0.624
No	73(23.0)	112(35.2)	92(28.9)	276(87.1)	
Use of supplements					
Yes	38(11.9)	53(16.7)	28(8.8)	119(37.4)	0.024
No	48(15.1)	75(23.6)	76(23.9)	199(62.6)	
Frequently used supplements during pregnancy					
FEFO	26(21.7)	43(35.8)	22(18.3)	91(75.8)	
Pregnancy care	2(1.7)	2(1.7)	3(2.5)	7(5.8)	0.727
MNP	8(6.7)	5(4.2)	5(4.2)	18(15.0)	
B Complex	1(0.8)	2(1.7)	1(0.8)	4(3.3)	

Table 4. Behavioural beliefs/attitudes.

Attribute	Mafiga n (%)	Kihonda n (%)	Mazimbu n (%)	Total n (%)	P-Value
EFA and healthy baby					
Agree	42(13.2)	80(25.2)	62(19.6)	184(58.0)	
Disagree	10(3.2)	19(6.0)	13(4.1)	42(13.2)	0.098
Neither	34(10.7)	28(8.8)	29(9.1)	91(28.7)	
EFAs are healthy					
Agree	41(12.9)	8(25.5)	63(19.8)	185(58.2)	
Disagree	14(4.4)	20(6.5)	15(4.7)	49(15.4)	0.142
Neither	31(9.7)	27(8.5)	26(8.2)	84(26.4)	
EFAs and weight management					
Agree	29(9.1)	41(12.9)	31(9.7)	101(31.8)	
Disagree	18(5.7)	41(12.9)	27(8.5)	86(27.0)	0.393
Neither	39(12.3)	46(14.5)	46(14.5)	131(41.2)	
Like using plant oil					
Agree	83(26.1)	122(38.4)	98(30.8)	303(95.3)	0.702
Disagree	3(0.9)	6(1.9)	6(1.9)	15(4.7)	
Tasted fish oil					
Agree	13(4.1)	18(5.7)	13(4.1)	44(13.8)	0.678
Disagree	73(23.0)	112(34.6)	91(28.6)	274(86.2)	
Like fish oil					
Agree	7(15.9)	9(20.5)	7(15.9)	23(52.3)	0.969
Disagree	6(13.6)	9(20.5)	6(13.6)	21(47.7)	
Reasons for liking fish oil					
Good taste	5(17.9)	7(25.0)	7(25.0)	19(67.9)	
Medicinal	2(7.1)	3(10.7)	1(3.6)	6(21.4)	0.677
Doesn’t clot	2(7.1)	0(0.0)	1(3.6)	1(3.6)	
No reason	1(3.6)	1(3.6)	0(0.0)	2(7.1)	
Reasons for disliking fish oil					
Nauseous	2(11.8)	2(11.8)	0(0.0)	4(23.5)	
Strong smell	2(11.8)	6(35.3)	4(23.5)	12(70.0)	0.277
Bad taste	1(5.9)	0(0.0)	0(0.0)	1(5.9)	
Is fish oil pregnancy safe					
Agree	27(8.5)	35(11.0)	29(9.1)	91(28.6)	
Disagree	4(1.3)	8(2.5)	2(0.6)	14(4.4)	0.547
Neither	55(17.3)	85(26.7)	73(23.0)	213(67.0)	
Reasons for being safe					
Natural	5(5.5)	9(9.9)	7(7.7)	21(23.1)	
Strong body	5(5.5)	4(4.4)	4(4.4)	13(14.3)	
Building body	4(4.4)	5(5.5)	0(0.0)	9(9.9)	0.487
Baby’s growth	6(6.6)	11(12.1)	12(13.2)	29(31.9)	
Genius babies	5(5.5)	5(5.5)	6(6.6)	16(17.6)	
No reason	2(2.2)	1(1.1)	0(0.0)	3(3.3)	
Reasons for fish oil being unsafe					
Chemicals	1(6.7)	5(33.3)	2(13.3)	8(53.3)	
Nauseous	1(6.7)	3(20.0)	0(0.0)	4(26.7)	0.695
Big babies	1(6.7)	1(6.7)	1(6.7)	3(20.0)	

EFAs=Omega 3 and omega 6 Fatty Acids.

Table 5. Normative beliefs.

Attribute	Mafiga n (%)	Kihonda n (%)	Mazimbu n (%)	Total n (%)	P-Value
Family/friends think I should consume EFAs					
Yes	56(17.6)	76(23.9)	51(16.7)	184(57.9)	0.100
No	30(9.4)	52(16.4)	53(16.1)	134(42.1)	
Family/friends expect me to consume EFAs					
Yes	50(15.7)	67(21.1)	54(17.0)	171(53.8)	0.635
No	36(11.3)	61(1.2)	50(15.7)	147(46.2)	
Family/friends advise me to consume EFAs					
Yes	39(12.3)	61(19.2)	48(15.1)	148(46.7)	0.946
No	47(14.8)	67(21.1)	55(17.4)	169(53.3)	
Family/friends probably consume EFAs					
Yes	71(22.3)	93(29.2)	68(21.4)	232(73.0)	0.030
No	15(4.7)	35(11.0)	36(11.3)	86(27.0)	
People like me probably consume EFAs					
Yes	60(18.9)	83(26.1)	59(18.6)	202(63.5)	0.164
No	26(8.2)	45(14.2)	45(14.2)	116(36.5)	

EFAs=Omega 3 and omega 6 Fatty Acids.

Table 6. Control beliefs.

Attribute	Mafiga n (%)	Kihonda n (%)	Mazimbu n (%)	Total n (%)	P-Value
I have control over essential fatty acids consumption					
Yes	72(22.6)	94(29.6)	73(23.0)	239(75.2)	0.084
No	14(4.4)	34(10.7)	31(9.7)	79(24.8)	
EFAs consumption is beyond my control					
Yes	15(10.7)	34(10.2)	30(8.5)	79(24.8)	0.072
No	74(16.4)	93(29.6)	72(24.2)	239(75.2)	
If it was up to me, I would consume EFAs					
Yes	73(23.0)	90(28.3)	70(22.0)	233(73.3)	0.015
No	13(4.1)	38(11.9)	34(10.7)	85(26.7)	
If want I can avoid using EFAs					
Yes	55(17.3)	74(23.3)	59(18.6)	188(59.1)	0.558
No	31(9.7)	54(17.0)	45(14.2)	130(40.9)	
I have the ability to consume EFAs					
Yes	74(23.3)	88(27.7)	69(21.7)	231(72.6)	0.004
No	12(3.8)	40(12.6)	35(11.0)	87(27.4)	
Presence of obstacles for consuming EFAs					
Yes	32(10.1)	37(11.7)	36(11.4)	105(33.1)	0.435
No	57(17.0)	90(28.4)	68(21.5)	212(66.9)	
Obstacles					
Money	19(17.9)	25(23.6)	21(19.8)	65(61.3)	
Partner	6(5.7)	11(10.4)	(8.5)	26(24.5)	0.433
Taboos	5(4.7)	3(2.8)	7(6.6)	15(14.1)	

EFAs=Essential fatty acids.

Table 7. General intention to consume omega 3 and omega 6 fatty acid food sources.

Attribute	Mafiga n (%)	Kihonda n (%)	Mazimbu n (%)	Total n (%)	P-Value
Intend to consume EFAs in the future					
Yes	53(16.7)	42(13.2)	37(11.6)	132(41.5)	0.001
No	33(10.4)	86(27.0)	66(20.8)	185(58.2)	
Intend to consume EFAs regularly					
Yes	51(16.0)	44(13.8)	42(13.2)	137(43.1)	0.001
No	35(11.0)	84 (26.4)	62(19.5)	181(56.1)	
Will consume after knowing health benefits					
Yes	82(25.8)	102(32.1)	77(24.2)	261(82.1)	0.002
No	4(1.3)	26(8.2)	27(8.5)	57(17.9)	

EFAs=Omega 3 and omega 6 Fatty Acids.

control over omega 3 and omega 6 fatty acids consumption and 24.8% said it was beyond their control. About 73.3% said that, if it was entirely up to them they would consume omega 3 and omega 6 fatty acid food sources. The main identified obstacles for consumption of omega 3 and omega 6 fatty acids were lack of money (61.3%), restrictions from the partners or parents (24.5%) as well as traditional beliefs (10.4%).

General intention

Information about general intention to consume omega 3 and omega 6 fatty acids is summarized in Table 7. A high proportion (58.2%) of respondents indicated that they were not intending to consume omega 3 and omega 6 fatty acid food sources and supplements. Most of them (56.1%) did not even agree to use them on regular basis. They only agreed to use them if they knew the health benefits of consuming omega 3 and omega 6 fatty acid food sources such as sardines for them and their unborn and born babies and they needed to be assured of their safety (82.1%).

Comparison of knowledge, attitude and practices (KAP) scores with demographic characteristics

This study compared knowledge, attitude and practices (KAP) scores with demographic characteristics as shown in Table 8. Results suggest no significant differences between participant's place of origin, age, occupation, marital and pregnancy status in terms of knowledge, attitude and practices. However, there was a significant difference between participants' education (never been to school, primary school, secondary and higher education) in terms of their knowledge ($p = 0.003$) and attitudes ($p = 0.004$). Those who have never been to school differ significantly with participants who had higher education in terms of knowledge and attitudes.

DISCUSSION

This is one of the few researches assessing knowledge, practices and intention to consume omega 3 and omega 6 fatty acids among Tanzanian pregnant and breastfeeding women. This will bring a new insight of what is known/not known before planning any nutritional intervention targeting improvement in consumption of omega 3 and omega 6 fatty acid sources among pregnant and breastfeeding women in Tanzania.

Knowledge represents the precondition to changing behaviour and if individuals do not have sufficient knowledge, they will have no reason to change old behaviours or adopt a new one (Reinholz and Andrews, 2020). In this study the authors assessed the current knowledge on omega 3 and omega 6 fatty acids food sources among pregnant and breastfeeding women in Tanzania. The respondents reported limited exposure to information regarding omega 3 and omega 6 fatty acids based on their food sources and functions. More than half of the respondents were not able to differentiate fats and oils which could probably be due to the presence of many brands of fats and oils. The sources of omega 3 and omega 6 were correctly identified may be due to the increased use of internet and the presence of different nutritional blogs and platforms. Knowledge regarding omega 3 and omega 6 fatty acids food sources, health benefits and consequences of deficiency was limited. Several studies conducted in other areas have also identified gaps in knowledge regarding omega 3 and omega 6 fatty acids (Thuppal et al., 2017; Hilleman et al., 2020). Low levels of knowledge could be attributed by dissemination of poor quality or even misleading nutritional information through the internet, social networks, and mass-media (Duarte et al., 2022). In order to improve omega 3 and omega 6 fatty acids' knowledge, it is important to increase efforts to educate people regarding the health benefits and consequences of consuming omega 3 and omega 6 fatty acid food sources prior, during and after pregnancy.

Table 8. Comparison of Knowledge, Attitude and Practices (KAP) Scores with Demographic Characteristics.

Variable	Number	Knowledge		Practice		Attitude	
		Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value
Age (Years)							
<18	2	15.00±7.07[a]		50.00±00.00[a]	0.068	42.86±20.20[a]	
18-24	105	17.24±16.82[b]	0.695	38.25±24.67[b]		45.03±21.68[b]	0.81
25-34	63	17.03±16.92[c]		46.28±26.78[c]		45.27±21.75[c]	
35-44	318	14.76±17.21[d]		38.62±28.53[d]		42.18±21.99[c]	
Education level							
Never been to school	23	14.35±17.01[abcd]		34.06±21.60[a]	0.18	36.02±18.71[ad]	
Primary school	159	13.40±13.21[bacd]	0.003	40.67±26.69[b]		43.67±20.47[b]	0.005
Secondary school	90	18.11±16.89[cabd]		44.07±26.48[c]		44.60±22.34[c]	
Higher education	46	26.09±23.52[dabc]		47.46±28.10[d]		51.80±24.35[da]	
Occupation							
Home maker	136	16.03±16.76[a]		38.85±25.25[a]	0.10	41.18±20.65[a]	
Employed in a formal/informal sector	94	17.23±18.80[b]	0.30	46.45±27.96[b]		50.46±21.94[b]	0.17
Self-employed	88	16.93±14.88[c]		42.61±26.73[c]		43.51±21.97[c]	
Marital status							
Single/never been married	97	15.05±14.59[a]		40.89±25.91[a]	0.06	41.24±20.71[a]	
Married	134	19.33±18.16[b]		46.45±26.64[b]		47.97±21.19[b]	
Separated/Divorced	21	13.33±20.33[c]	0.312	41.27±29.64[c]		45.58±24.59[c]	0.17
Widowed	7	7.14±9.51[d]		28.57±24.93[d]		42.86±29.73[d]	
Cohabiting	59	15.42±16.12[e]		35.88±23.33[e]		42.14±21.94[e]	
Have children							
Yes	262	16.26±16.56[a]	0.57	41.16±26.97[a]	0.16	43.24±21.68[a]	0.74
No	56	18.39±18.37[b]		46.73±24.49[b]		50.77±20.91[b]	
Pregnant							
Yes	101	17.23±17.78[a]	0.38	44.22±24.67[a]	0.14	45.54±21.07[a]	0.63
No	217	16.36±16.47[b]		41.17±27.45[b]		44.11±22.02[b]	

Values with different superscripts in a row differ significantly ($p<0.05$).

Other studies have given different suggestions on how to increase nutritional knowledge (Blondin and LoGiudice, 2018; Hussein et al., 2018; De Seymour et al., 2019).

Regarding practices on omega 3 and omega 6 fatty acids, most of the participants took into account the type of fat they consume since most of them preferred plant-based lipids. Fats have always been linked with increased risks for non-communicable diseases and therefore increased consciousness among the consumers (Hermann, 2018). Lower price was one of the reasons for choosing a certain brand of fat/oil. This is similar to what have been reported by Priyati and Tyers (2016) and FAO (2020). Other factors that influence fat choices are discussed by Klopčiča et al. (2020). In terms of consumption of omega 3 and omega 6 fatty acid food sources, more than half of the respondents declared not to consume. This may be contributed by the lack of information and knowledge regarding the available brands as well as health and nutritional benefits associated with it. Other studies have also reported lower consumption of omega 3 and omega 6 fatty acid food sources and the reasons given were lifestyle, socio-demographic issues as well as previous experiences (Supartini et al., 2018; Maciel et al., 2019; Rahman et al., 2020). Therefore there is a need to increase more efforts to educate women on the availability, food sources, preparation and consumption of omega 3 and omega 6 fatty acid foods among pre-pregnant, pregnant and breastfeeding women.

The present study also assessed women's attitude

towards omega 3 and omega 6 fatty acids. Attitudes are emotional, motivational, perceptive and cognitive beliefs that positively or negatively influence the behaviour or practice of an individual (Verplanken and Orbell, 2022). Most of the participants in this study agreed that consumption of omega 3 and omega 6 fatty acid food sources and supplements is good for their own health, for unborn babies and they can even be used for weight management. This is a good indication that any efforts targeting to improve intake of omega 3 and omega 6 fatty acids may succeed. Also most of the study participants had never tasted fish oil or any food or supplement made from fish oil and for those who happened to taste it, agreed that they liked it. These low levels of fish oil intake are in line with what was reported by Seymour et al. (2019) in Australia. The main reason given by those who liked it was a good taste and perceiving it as a medicine. Also, most of the study participants didn't know whether consumption of fish oil was safe or not during pregnancy and their main concern was the presence of chemicals that might harm the baby in the womb. Similarly (Judge, 2018) reported low intake of fish oil and fish oil-products and the main reason was lack previous experience and fear of potential health effects in the future.

An individual's behaviour may also be influenced by what is accepted or not accepted by specific people or groups and this may dictate whether behaving in a particular fashion is appropriate or not (Fang et al., 2017). Based on the results from this study, it seems that the people who are closer to a person may have a greater influence on the decision to consume omega 3 and omega 6 fatty acid food sources. This means that the more positive their peer groups are, the higher the probability of changing their behaviour. This agrees with what was reported by Risti et al. (2021) as well as Chen and Antonelli (2020) in Indonesia and Italy, respectively. Other factors that may influence an individual's behaviour include perceived health benefits, the use of media as well as the advice given by health professionals (Verplanken and Orbell, 2022).

Control belief refers to the presence of factors that may facilitate or impede performance of the behaviour and the perceived power of these factors (Nafaji et al., 2018). Based on the results from this study, it seems that most women have the ability to make decision over consumption of omega 3 and omega 6 fatty acid sources but their main concern is the cost of the products. This means that if low-cost, safe and user-friendly products are developed there is a chance for them to be accepted by the consumers. This finding is consistent with the findings of the previous research done by Wu et al. (2015) in China.

Conclusion

This study reveals limited knowledge and low consumption of omega 3 and omega 6 fatty acid food sources and supplements especially during pregnancy. Most of them showed positive attitude towards omega 3 and omega 6 fatty acid food sources and this gives hope of success for any attempt to improve consumption of omega 3 and omega 6 fatty acid food sources.

Level of education was reported as one of the factors that significantly influence consumer's knowledge and attitude. Therefore, attempts to increase consumption of omega 3 and omega 6 fatty acids among pregnant and breastfeeding women have to pay attention on their level of education.

Also based on this study, most of people are willing to consume omega 3 and omega 6 fatty acid food and other sources if they are aware of the health benefits associated with them. Therefore the findings from this study may contribute to the government and other stakeholders' efforts towards improving maternal and child health through development of low-cost and nutritious recipes using locally available ingredients.

CONFLICT OF INTERESTS

The authors have not declared any conflicts of interests.

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