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KNOWLEDGE, USE AND SENSORY EVALUATION OF RED PALM OIL *OGI* BY CAREGIVERS IN MAKURDI, NIGERIA

Adewuyi OA [*1], Abu JO[2], Amuta EU[3], Abu GA[4], Iombor TT [5] and EK Ingbian[6]

Olufemi A Adewuyi

[*]Corresponding author email: olufix07@yahoo.co.uk

[1]Graduate student, Department of Food Science and Technology, University of Agriculture PMB 2373 Makurdi, Nigeria

[2]Associate Professor and Head, Department of Food Science and Technology, University of Agriculture Makurdi, Nigeria Email; joabuza@yahoo.co.uk

[3]Professor and Dean, Postgraduate School, University of Agriculture Makurdi, Nigeria

[4]Asssociate Professor, Department of Agricultural Economics, University of Agriculture Makurdi, Nigeria

[5]Lecturer I, Department of Home Science and Management, University of Agriculture Makurdi, Nigeria

[6]Associate Professor, Department of Food Science and Technology, University of Agriculture Makurdi, Nigeria (Now Deceased)

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ABSTRACT

Vitamin A deficiency is one of the major public health challenges in many developing countries affecting mainly children under 5 years of age and contributes to severity of life-threatening infections such as diarrhoea and measles. Over the years, several effective strategies have been adopted to combat vitamin A deficiency with the attendant challenge of sustainability. Food-based approaches based on vitamin A-rich, locally available food sources are considered sustainable and could help in filling this gap. The use of red palm oil among other locally available pro-vitamin A foodstuffs is recommended for incorporation into complementary foods given to children under 5 years of age by health workers in Nigeria. This study was conducted to ascertain the level of awareness, use and sensory evaluation of red palm oil *ogi* (a cereal-based porridge) by caregivers of under-fives within Makurdi, Nigeria. Data were obtained through a cross-sectional survey and two focus group discussions. The survey involved 100 respondents that were purposively sampled from three well patronized health facilities rendering post-natal services in Makurdi. The results of the survey were analyzed using descriptive statistics. The focus group discussions involved 17 members in two separate groups and responses were sorted and summarized. The results show that though caregivers consider red palm oil as a taboo-free cooking ingredient, knowledge on its use in *ogi* was low (11%). However, some caregivers were willing to adopt red palm oil *ogi* provided the method of preparation is demonstrated and presents no adverse effects on the child. *Ogi* prepared with 5 and 10% red palm oil (w/v) scored 6.8 and 6.6 for maize, 5.9 and 6.0 for millet, respectively for overall acceptability on a 9-point Hedonic scale while *ogi* without red palm oil was the most acceptable. This study has identified low awareness in the use of red palm oil *ogi* among caregivers of under-fives in Makurdi; ignorance about red palm oil's nutritional benefits and appropriate preparation methods as well as actual concentration of red palm oil to be employed as some of the critical gaps in the use of red palm oil *ogi* in alleviating the burden of vitamin A deficiency among children under 5 years of age in Makurdi, Nigeria.

Key words: Knowledge, Red palm oil, *Ogi*

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INTRODUCTION

Vitamin A is a vital micronutrient associated with the development of children's immune as well as visual systems and essential for optimal health, growth and development [1, 2]. Vitamin A deficiency (VAD) has been identified as a major public health challenge in many developing countries of the world affecting mainly children under five years of age (U5) [3, 4, 5, 6]. Vitamin A deficiency contributes to the incidence of sight problems and severity of life-threatening infections like diarrhoea and measles as well as mortality from malaria [7, 8, 9]. Furthermore, VAD may be a major cause of U5 mortality in Nigeria. The Micronutrient Initiative (MI) and the National Committee on Food and Nutrition of Nigeria (NCFN) recently reported a prevalence of 29.5% of VAD amongst children under 5 years of age in Nigeria [10].

Several strategies have been employed to combat VAD and these include fortification of food ingredients like flour and vegetable oil, administering vitamin A supplements and bio-fortification. However, the food-based approach appears to be the most sustainable in developing countries. Consequently, emphasis is being placed on dietary diversification and food-to-food fortification subject to availability and affordability of targeted local foodstuffs. These efforts include the inclusion of pro-vitamin A rich sources such as carrots and orange fleshed sweet potatoes in complementary foods.

Given red palm oil's high carotenoid contents, about 10.1g/d of red palm oil (RPO) has been estimated to supply 100% of the vitamin A requirement of a 4-6 year old child; that is 450 retinol equivalents per day which according to USDA/ARS is about 2.2 teaspoons per day [11, 12]. Hence, it is recommended for incorporation into complementary foods by health workers in Nigeria [13, 14, 15]. However, it is not known how many caregivers understand and practice this approach in their homes and the challenges that may be confronting them. This study ascertained the extent of knowledge, use and sensory evaluation of red palm oil in *ogi* (a traditional cereal-based porridge consumed by children below 5 years of age) and highlights some of the challenges confronting this potentially useful food-based approach in combating vitamin A deficiency (VAD) in Nigeria.

MATERIALS AND METHODS

Research design: The study adopted a descriptive survey design [16]. Purposive sampling was used to select hospitals while individual respondents were selected based on their willingness to participate [17]. A total of 100 respondents participated.

Respondents: The study population consisted of caregivers attending antenatal and postnatal check-ups in three well attended Government hospitals within Makurdi, Nigeria.

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Instrumentation: In this study, quantitative (survey) and qualitative methods (focus group discussion) were adopted [16]. For the survey, a pre-tested questionnaire was used to obtain information from the participants. The questionnaire contained open-ended and close-ended questions. A question guide was employed in two separated groups for the focus group discussion sessions using a total of 17 participants.

Method of data collection: The questionnaires were administered to the participants on a one-on-one basis and on-the-spot retrieval was ensured on completion. Data were statistically analyzed using the SPSS version 16.0 statistical software package. Percentages of the frequency counts were used to describe information given by the respondents. The focus group discussions involved two personnel, the moderator of the FGD assisted by a secretary. Each session lasted 30-45 minutes using an audio recorder to collect responses which were subsequently summarized [18].

Sensory evaluation: The panelists involved 15 caregivers. Consent was sought followed by a brief training on how to score the samples. The sensory attributes were rated using a 9-point Hedonic scale where 9= like extremely, 8= like moderately, 7= like slightly, 6=like, 5=neither like nor dislike, 4=dislike, 3= dislike slightly, 2= dislike moderately and 1= dislike extremely [19]. Data collected were subjected to one-way analysis of variance (ANOVA) at 5% level of significance.

Ethical approval of the study

The research protocol was approved by the Ethics Committee of each of the government hospitals selected and a written consent was sought from the participants before their participation in the study.

RESULTS

The socio-demographic characteristics of the respondents are presented in Table 1. Most caregivers were between the ages of 26 and 35 years (52%) and possessed either a secondary or tertiary education qualification (87%). Only 47% were full-time home managers. The rest (53%) were employed outside of their homes.

Information on the use of complementary foods (CF) by caregivers in Makurdi, Nigeria is presented in Table 2. All the respondents indicated that they fed their children under 5 years of age with CF. While 21% fed their children exclusively with locally prepared CF, 79% adopted commercial CF in combination with local CF for complementary feeding. Most caregivers (78%) introduced CF from six months and above daily (93%) using cups and spoons (53%), feeding bottle (27%) as well as plate and spoons (20%). The CF of choice were usually given to the children at a daily frequency of three (52%) or four (35%) times.

Respondents' knowledge on the processing and preparation of *ogi* in Makurdi, Nigeria is summarised in Table 3. Most (98%) caregivers could process cereal grains into *ogi*. Most preferred millet (76%) for *ogi* processing. The preferred duration of soaking and fermentation of cereal grain was 24hrs.

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Information on caregivers' knowledge and willingness to adopt RPO *ogi* in Makurdi, Nigeria is summarised in Table 4. While 99% of respondents had used red palm oil as a food ingredient, only 11% indicated ever using RPO in *ogi* preparation. Of those that used RPO in *ogi*, most (53.8%) used two spoons of RPO (10mls) per cup of *ogi* (approx 100g) for their children daily (76.9%). All the caregivers indicated that there was no known taboo against the use of RPO in the meals of children below 5 years of age. However, only 17% of respondents were willing to feed their children with RPO *ogi*. While 42% were not willing to use RPO *ogi*, 41% were indifferent in their disposition towards RPO *ogi*.

Two separate Focus Group Discussions (FGDs) were held to verify the information obtained from the survey. In terms of cereal preference and duration of fermentation for *ogi*, most respondents indicated preference for millet grains fermented for less than 48hrs for *ogi* preparation. In addition to *ogi*, the FGD listed other CFs frequently fed to children below 5 years of age to include beans, rice, mashed yam, custard, pasta products and family meals in general. The choice of complementary food to use by caregivers depended on availability, affordability, child's preference and beliefs in that respective order. Furthermore, while the respondents indicated that RPO was a taboo-free, popular food ingredient; none had thought of, or had been informed about incorporating RPO in *ogi*. Equally, none was aware of the benefits of adding RPO in the preparation of *ogi*. However, most participants in the FGD indicated willingness to incorporate RPO in *ogi* if the method of preparation was demonstrated and RPO *ogi* presented no adverse effects on the child.

The result of sensory evaluation of RPO *ogi* from maize and millet is presented in Table 5. While the 'appearance' of RPO *ogi* at 10% (w/v) was adjudged to be better than the control *ogi* when maize was employed, the 'appearance' of RPO *ogi* was consistently scored lower than the control *ogi* for all sensory attributes when millet was used. In addition, the score for 'texture' of RPO *ogi* decreased with increasing RPO concentration while the scores for 'taste' in both maize and millet RPO *ogi* increased with RPO concentration. In terms of 'overall acceptability', the control *ogi* samples from both maize and millet scored better than their RPO counterparts. *Ogi* with 5, 10 and 15% (w/v) RPO scored 6.8, 6.6 and 5.4 for maize and 5.9, 6.0 and 5.2 for millet, respectively for 'overall acceptability'.

DISCUSSION

The majority of the respondents were literate adult mothers and were, as expected, knowledgeable about complementary food preparation. Previous research has shown a positive relationship between level of education and nutrition knowledge [20]. In addition, allocation of time for the preparation of local CF may not be difficult for most caregivers as they are mostly either home managers or self employed.

A significant number (21%) of respondents rely wholly on locally prepared CF as sources of nutrients for their children below 5 years of age. Complementary food is

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normally recommended as from six months to augment breast milk nutrient shortfalls for the rapidly growing child [21, 22]. In this study, it is noteworthy that adherence to the recommended age (6 months) for introducing CF by the caregivers (78%) was higher than the national figure for exclusively breast-fed children presumably because the respondents in this study were more educated than the average Nigerian population.

In addition to the 21% relying exclusively on locally prepared CFs, 79% of caregivers combined locally prepared CFs with the commercial samples in feeding their children. It has been previously observed that no single complementary food was capable of providing adequate nutrients to meet the daily nutrient requirements for children below 5 years of age [23]. This might partly explain the high incidences of VAD in many parts of Nigeria as most locally prepared CFs are prepared exclusively from low vitamin A sources such as cereals and tubers. Therefore, the practice of incorporating pro-vitamin A-rich red palm oil in CFs such as *ogi* could be helpful in improving local CFs pro-vitamin A content and energy values. It may be necessary however, to quantify the actual contribution of this approach to the total vitamin A recommended daily allowance (RDA) for children under 5 years of age living in this region. Furthermore, given that foods prepared with RPO are highly prone to rancidity, studies may be required to ascertain the shelf stability of dry RPO *ogi*. In the interim, addition of RPO to *ogi* at the point of preparation of the wet paste is recommended to avert the potential challenge of rancidity.

It is noteworthy that most caregivers in Makurdi prefer millet in the preparation of *ogi* compared to maize in many parts of Nigeria due to existing perception that millet is more nutritious and possesses desirable flavour. Furthermore, the most preferred duration of fermentation for *ogi* preparation in this study ($\leq$ 24 h) is lower than the 24-72 h recommended by previous workers, further indicating possible regional variations in the preparation of *ogi* across Nigeria [24].

Although the respondents in this study considered red palm oil (RPO) to be a taboo-free cooking ingredient, the low adoption of RPO *ogi* might have been due to low awareness and knowledge of its preparation. Adoption of this food-based approach could be easily enhanced through proper nutrition education and demonstration of the preparation techniques and benefits of utilizing RPO *ogi*. Some researchers have used RPO in other foods to intervene in VAD with some success [25, 26].

The focus group discussion confirmed most of the information obtained from the survey. For instance, most caregivers in the FGDs preferred millet for *ogi* preparation just as was the case in the survey. In addition, the factors affecting the choice of CF as stated by caregivers were consistent with a previous report [27].

Acceptable RPO *ogi* could be prepared from both maize and millet at 5-10% (w/v) since scores of 6 or 7 correspond to ‘like’ and ‘like slightly’ on the 9-point Hedonic scale, but higher RPO concentrations resulted in lower scores on some sensory criteria. High RPO concentration led to *ogi* with poor textural properties owing

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possibly to poor oil-starch interactions resulting in low gel strength and viscosity [28]. Consequently, the promotion of red palm oil in the preparation of *ogi* should begin with lower concentrations.

CONCLUSION

The findings from this study suggest that the level of awareness on the use of red palm oil *ogi* in Makurdi, Nigeria is low. Gaps identified include ignorance on the nutritional benefits of red palm oil to the health of children below 5 years of age as well as method of preparation and concentration of red palm oil to be employed in red palm oil *ogi.* A significant number of caregivers may be willing to adopt red palm oil *ogi* if taught how to prepare it with no adverse effects on the child. Acceptable red palm oil *ogi* can be prepared using either millet or maize at 5-10 % (w/v) red palm oil concentration. Nutrition education on the use of affordable, pro-vitamin A-rich food sources such as red palm oil in *ogi* should be strengthened. Areas of further studies should include physicochemical properties and storage stability of red palm oil *ogi*. In addition, clinical trials should be carried out to determine the actual contribution of red palm oil *ogi* to serum retinol level in children under 5 years of age.

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Table 1: Socio-demographic characteristics of caregivers in Makurdi, Nigeria (n = 100)

	Characteristics	n	Percentage
Age (years)	16-25	42	42.0
	26-35	52	52.0
	36-45	4	4.0
	46-55	2	2.0
Religion	Christianity	92	92.0
	Islam	5	5.0
	Others	3	3.0
Educational level	Primary	5	5.0
	Secondary	40	40.0
	Tertiary	47	47.0
	No formal	8	8.0
Profession	Civil servant	13	13.0
	Public servant	6	6.0
	Self employed	34	34.0
	Home manager	47	47.0

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Table 2: Use of complementary food by caregivers in Makurdi, Nigeria (n = 100)

Questions	Options	Percentage
What complementary food do you	Commercial only	-
give to your child?	Local only	21.0
	Both	79.0
At what age do you start giving	Below 6 months	22.0
complementary foods?	At 6 months and above	78.0
What feeding tools do you	Plate and spoon	20.0
employ?	Feeding bottle	27.0
	Cup and spoon	53.0
How many times in a day?	Once	4.0
	Twice	9.0
	Thrice	52.0
	Four times	35.0

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Table 3: Caregiver's knowledge on the processing and preparation of *ogi* in Makurdi, Nigeria (n = 100)

Questions	Options	Percentage
Can you prepare *Ogi*?	Yes	98.0
	No	2.0
Which cereal grain do you prefer or use in making *ogi*?	Maize	18.0
	Millet	76.0
	Sorghum	6.0
For how long do you soak the grain?	Less than 24hrs	30.9
	24hrs	53.6
	48hrs	11.3
	72hrs	2.1
	96hrs and above	2.1
How long do you allow fermentation to take place?	Less than 24hrs	42.3
	24hrs	45.4
	48hrs	9.3
	72hrs	1.0
	96hrs and above	2.1
How do you separate water from *ogi*?	Sieving	37.1
	Decanting	62.9
	Others	-

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Table 4: Caregiver's knowledge and willingness to adopt red palm oil *ogi* in Makurdi, Nigeria (n=100)

Questions	Attributes	Percentages
Have you ever used red palm oil as cooking ingredient?	Yes	99.0
	No	1.0
How often do you use it?	Daily	92.9
	Weekly	7.1
Have you ever mixed red palm oil with *ogi* and served as complementary food?	Yes	11.0
	No	89.0
If yes, at what ratio of red palm oil to *ogi*?	*1 spoon : 1 cup	38.5
	2 spoons : 1 cup	53.8
	3 spoons : 1 cup	7.7
	4 spoons : 1 cup	-
Would you like to feed your child with red palm oil *ogi*?	Yes	17.0
	No	42.0
	Indifferent	41.0
If yes, how often?	Daily	76.9
	Weekly	23.1
Is there any belief or taboo against consumption of red palm oil by U5 children in your community?	Yes	-
	No	100.0

* Ratio of red palm oil to *ogi*. 1 spoon is equivalent to 5mls and 1 cup is equivalent to 100g of cooked *ogi*

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Table 5: Sensory evaluation of red palm oil (RPO) *ogi* by caregivers in Makurdi, Nigeria

Attributes	Maize *ogi*	RPO Maize *ogi* (5% w/v)	RPO Maize *ogi* (10% w/v)	RPO Maize *ogi* (15% w/v)	Millet *ogi*	RPO Millet *ogi* (5% w/v)	RPO Millet *ogi* (10% w/v)	RPO Millet *ogi* (15% w/v)
Appearance	7.0±2.5^{b}	7.3±1.8^{b}	7.9±1.4^{a}	6.0±3.0^{d}	7.4±2.7^{b}	6.7±2.3^{c}	6.6±2.4^{c}	5.9±2.4^{d}
Taste	6.7±2.6^{b}	6.4±2.2^{c}	6.9±2.3^{b}	6.1±2.6^{c}	7.9±2.5^{a}	6.4±2.2^{c}	7.1±2.2^{b}	4.7±2.6^{d}
Aroma	6.1±3.0^{c}	6.7±1.9^{b}	6.2±2.4^{c}	5.7±2.4^{d}	7.3±2.5^{a}	5.4±2.6^{d}	6.3±1.9^{c}	4.5±2.4^{e}
Texture/Mouth feel	7.9±2.4^{a}	7.5±1.3^{a}	6.4±2.8^{b}	6.2±2.7^{b}	7.1±1.9^{ab}	6.5±1.8^{b}	6.0±2.3^{bc}	5.7±2.7^{c}
Overall acceptability	7.4±2.7^{a}	6.8±3.0^{ab}	6.6±2.6^{b}	5.4±2.7^{cd}	7.1±2.9^{a}	5.9±2.9^{c}	6.0±3.1^{c}	5.2±3.1^{d}

Values with different letters are significantly different ($p<0.05$).

Keys: 9-like extremely
8- like moderately
7- like slightly
6- like
5- neither like nor dislike
4- dislike
3- dislike slightly
2- dislike moderately
1- dislike extremely

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