

Research Article

Feeding Premasticated Food to Breastfeeding and Weaned Infants among Sudanese Women, Khartoum North

Dya Eldin M. Elsayed, MD, Ali Mohieldin Mahgoub PhD, Aida Abd Elhamed Salim PhD, Sahar Mohammed Ahmed Hamid

Abstract:

Premasticated of solid food, when an individual partially breaks down food by chewing and feeding it to another person, usually children, from mouth to mouth, using the hand or by other tools e.g. spoon is common various societies in the world. We also did not know whether Sudanese women practice the premasticated feeding. So, we conducted this study to assess breastfeeding, complementary feeding behavior, presence or absence and rates of premasticated food transfer and infant age, and assessed the food species and part used. The study was conducted in Khartoum North locality, Khartoum State, Sudan. We used descriptive cross-sectional design to complete the study. The study targeted nursing mother with a child less than 24 months of age. The sample size was calculated to be 800. Two thirds of surveyed nursing mothers have had heard of premastication of food. Most heard of it from older generations. Yet, 94 (11.9%) premasticated food for the current young children. They claimed that they start premastication of food after the sixth month of the infant age, and stop the practice before the 24th month. Although many scientists around the world have recognized the possibility of transmitting infection by premasticated food from the mother to the infant, the practice is not without significant benefits. Some authors believe that premastication of food by senior person and deliver it to the infant can help stimulating the immune system in infants. The study was reviewed and approved by the Research Ethics Committee at Alzaiem Alazhari University. Written informed consent was obtained from each individual participant.

Key words: premastication; breastfeeding; infants; nursing; mothers

Introduction

In sub-Saharan Africa, including the Sudan, women breastfeed their children from birth to about 24 months because breastfeeding satisfies the nutritional needs of the infant and is habitually encouraged by other family members as a cultural norm. Furthermore, breast milk substitutes are either not affordable or can easily be contaminated. Breastfeeding protects against infant diarrheal and upper respiratory diseases and has many other well-documented biological benefits (1, 2, and 3).

A survey of the literature shows that the practice of feeding the child pre-masticated (pre-chewed) food is very common. Pre-masticated solid food is when an individual partially breaks down food by chewing and feeding it to another person, usually children, from mouth to mouth, using the hand or by other tools such as spoon (4).

In a medical history section in an article entitled "Infant feeding through the ages", Radbill (5) summarized in 1981 the practices of wet nursing, animal nursing, hand-feeding (which includes pre-mastication), animal milks, modified foods and packed milks and foods. In Africa, early 1980s reports described supplemental feeding of pre-chewed foods delivered by hand to infant among some traditional Central Africa communities (6). Most of the literature

relates the practice of using pre-masticated food to the time of weaning, although some of the old literature appears to suggest this practice was another form of supplemental feeding (where breastfeeding was not completely stopped).

Premastication of food is also found in other parts of the world outside Africa. However, recent reports from many countries associate the practice with transmission of certain microorganisms from mothers to the infants. In a USA, study indicates that the practice that is potentially associated with transmission of Human Immunodeficiency Virus (HIV) to the infant (7). Reports exist from Northern Thailand, Pakistan and Canada describing the adverse effects of pre-masticated food and other practices. In Chiang Mai, Northern Thailand bottle-feeding, pre-mastication and mashing of foods were significantly associated with increased bacteria in weaning foods (8). In Pakistan, high prevalence of *Helicobacter pylori* among children was assumed to be related to the use of pre-masticated food by the mothers and early exposure of these children (9). Among the Canadian Indian populations, mothers used pre-masticated food for infant feeding compared to commercially prepared infant foods (10).

Despite the widespread practice of breastfeeding in Sudan, our knowledge of the factors related to infant feeding and weaning is inadequate. For example, we do not know the exact definition of weaning as reported by Sudanese woman. Is it complete cessation of breastfeeding or is intermittent (interrupted) nursing permitted over a short or extended period after breastfeeding cessation has been reported? (11). We also do not know whether or not the pre-masticated feeding is practiced by Sudanese women, and if yes; what is its prevalence? What are the effects of this mode of feeding among Sudanese HIV (and other infections) infected women who breastfeed, wean but practice intermittent breastfeeding or post-weaning when complete cessation of breastfeeding occurs?

We surveyed breastfeeding, complementary feeding behavior, presence or absence, rates of pre-masticated food transfer and infant age, as well as the food species and components/portions utilized.

Methods:

We have adopted cross-sectional and real-time cross section design to complete this study. The study was conducted in the Khartoum North city. It included breastfeeding (nursing) women

The inclusion criteria included:

- Mothers of children ≤ 2 years of age.
- Mothers of breastfeeding (or recently [within 1 month] weaned) infants.
- Mother willing and able to provide informed consent.

Sample Size

A sample of 800 breastfeeding women was determined. With a confidence Interval of 95%, this sample will be approximately 5% around the point estimate. This sample size allowed a good estimate of the proportion for use of pre-masticated food in Khartoum North Locality.

The sample size was calculated using Slovin’s formula: we use Slovin’s formula because nothing is known about the pre-mastication behavior among the study population.

$$n = \frac{N}{1 + N(d)^2}$$

n: sample size

N: total target population

d: degree of precision

$$n = \frac{43281}{1 + 43281 (.05)^2} = 800$$

Target population in Khartoum North Locality	43281
sample size=	800

5.2 Sampling Technique

A two-stage cluster sampling technique with probability proportionate to the size of population was used. In the first stage the smallest population groups unit in each administrative unit (cluster) was determined. The total numbers of clusters as well as the population size of each cluster were determined using the data from State Ministry of Health, local administration and Central Bureau of Statistics.

Interview

Consecutively presenting, consenting women were interviewed to complete the study questionnaire. Trained study assistants conducted the interview in a form of questionnaire. The questionnaire consisted of 41 questions. It included closed and open-ended questions, written and communicated to the participants in Arabic language. The interview took 45 – 60 minutes. The desired data from breastfeeding women included practices of feeding pre-masticated food and weaning of infants.

Sampling continued until the required sample was obtained. Each participant was given an identifier code; no names were recorded

Data Analyses

Data was checked for completeness and entered on-site. Proportions were estimated, descriptive analyses of other

variables related to weaning practices were presented. Point estimates and 95% confidence intervals was calculated.

Data Management

Microsoft Access was used for data management. Each participant had a chart that would have the Case Report Form. Data collected was checked for consistency and completeness and double entered locally in a computerized database. The data manager has checked for inconsistencies and completeness.

Ethical considerations:

The study protocol and the informed consent form were reviewed and approved by the Research Ethics Committee at Alzaiem Alazhari University.

A signed consent form has been obtained from each individual participant. The consent form described, in simple Arabic language, the purpose of the study, the procedures to be followed, and the risks and benefits of participation. Data was collected anonymously to maintain confidentiality of private information. All records are kept locked in a password protected computer. Data entry was performed using a coded number for each questionnaire form. The consent form included permission of nursing mothers to publish this work.

Results:

A sample of 800 nursing mothers was supposed to be interviewed in this study. We were able to survey 789 with response rate of 98.6%. Yet the respondents left some questions without response.

The ages of the surveyed women ranged between 20 -50 years. Four hundred thirty-three (60.5%) women fall in the range 20-30 years, 269 (37.5%) between 31-40 and 14 (2%) fall in the age group older than 41 years.

The women were asked about their marital status: 762 (96.6%) of them are married, the other are separated, divorced and widow nine for each category.

We asked the surveyed women about the highest level of education, which one of them has reached. Their responses are illustrated in table No: 1. Five hundred ninety-seven (76.4%) of them do not have work, while 188 of them are doing various jobs. Only five of their husbands do not have work, while the whole 780 have work.

All the surveyed women have children (785) of various age groups, but less than 24 months. The female children were 351 (44.7%) and the males were 434 (55.3%). Of these children 19 (2.4%) are neonates i. e. their age is less than one month, 406 (52.1%) their ages range is 1 – 12 and 354 (45.4%) are

elder than 12, but younger than 24 months. The number of children who are breastfed is 622 (77.1%). Six hundred ninety (97.2%) of women confirmed that they breastfeed their children themselves.

The number of times a child is breastfed, usually varies during the day. When 288 (57.3%) lactating women give their child less than 5 suckling per day, 179 (35.6%) feed the child from six to ten times, 36 women (7%) feed the child more than ten times per day. However, 163 of the surveyed women stopped breastfeeding their children. Ten (6.1%) of the nursing mothers stopped breastfeeding when the child was between six and ten months old. 30 (18.4%) stopped breastfeeding when the child was between 11 and 15 months, 54 (33.1%) of them stopped breastfeeding when the child was between 16 and 20 months, while 69 (42.3%) women stopped breastfeeding when the child turned 21 months old. The surveyed women claimed that they stopped breastfeeding for various reasons (see tab. 2).

The study revealed that 622 women breastfeed their children. We discovered that 611 (98.2%) give their children complementary food. To explore in what month women entered complementary feeding see (Table 3). Nursing mothers usually start

complementary feeding with fluids like water, fruit juice, cow's milk and yogurt.

To feed their children 313 women (40.4%) predominantly use cup, 35 of them (4.5%) use spoon, 202 (26%) use both cup and spoon, 126 (16.2%) use the feeding bottle, while 95 of the surveyed women use different kitchen utensils (12.2%). They also give the children various types of food such as rice, the bread, bean, cheese, potato, minced meat, eggs, vegetables, fruits and candy. They usually give the fluids and food one to two times per day.

The study was interested in knowing whether the study participants had heard of pre-masticated food to feed young children. It revealed that 545 (69%) have heard about this practice, while 208 (26%) didn't hear of it, while 36 of them didn't respond to this question. One hundred twenty-eight (23.4%) of the women who know this practice declared that their mothers told them, 60 (11%) have been told by other family member. 357 (65.5%) heard about it from different sources in the community. Although 111 (14%) among the surveyed nursing women used to masticate food for feeding older children, only 94 (11.9%) pre-masticated food for the current young children. Almost all nursing mothers (90 95.7%) confirmed the onset of pre-mastication

of food after the sixth month. Usually they pre-masticated food for young children once a day. However, 5 (5.3%) of the women do it whenever they feed the child during the day. In order to see when it was the last time the mother fed her young child (see table 4).

The mothers stated that pre-mastication of food before giving it to their child to crush it 85 (90.4%), while six (9.6%) of them said that cooling the hot food is the purpose of masticating. Nevertheless, 66 (70%) claimed that they do pre-masticate food to encourage their children to eat. The surveyed nursing mothers claimed that they stop masticating food when the children's teeth grow i.e. they feel the child is old enough to chew the food him/ herself.

The study found that some family members 42 (44.6%) other than the mothers masticate food for infants. Grandmothers participate in masticating food in 22 (52.3%) families, child's fathers in eight families (19%), mother's sister in seven (16.6%), other family members, including the elder siblings in four (9.5%) of the families.

The list of the items that are usually masticated before giving it to the child includes meat (usually beef), bread, rice, potato, date, candy, lupine, chicken, peanuts, venerable fruits and vegetables.

Discussion:

To our knowledge, our study is the first of its kind ever to be conducted in our country (The Republic of the Sudan). We were unable to identify any studies concerned with the effect of premastication on the nutritional status, morbidity, or nutritional diversity in Sudan. Although we believe that premastication is a widespread phenomenon, that was adaptive and conferred survival benefits at some point in human history, including our country. Center for Disease Control and Prevention in the United States of America has mentioned that premastication of foods for infants is a common practice among many different racial and ethnic groups in the United States. It is also widely practiced in Africa and many developing countries and historically was considered an important feeding method for providing protein to breastfed infants (12, 13). Yet a few of the respondents in this study do it. Our study revealed that more than two-third of the respondents have heard about this practice. Most of them heard of it from their mothers and/or older siblings and other senior community members, which indicated the spread of the phenomenon in the past, but has declined in modern times. It was observed in families that resort to the process of premastication of solid food

that they begin after the sixth month of the infant's age. They begin introducing complementary food at that age. However, after the sixth month of life, infants need other food in addition to breast milk to grow up. Nursing mothers resort to introduce complementary food at this particular age, because of anatomical and physiological status, they do not have teeth to help them chew food. Chewing is an important skill and children need to develop jaw strength and learn to maneuver food around their mouths (14). Nursing women initially introduce the complementary food with fluids like water, fruit juice, cow's milk and yogurt. They predominantly use cup, spoon or both cup and spoon (15).

When it comes to solid food, premastication was the alternative to infant feeding during this transitional period (16). Therefore, many nursing mothers have chosen using premasticated food before giving it to their infants to crush solid food and make it easy for them to swallow. Another purpose for premastication is cooling the hot food. It also gives mothers opportunity to taste chili peppers or other that infants can never tolerate. Even so, premastication of food on an emotional and psychological level encourages infants to simulate their mothers in the eating habit, which

increases the frequency of mealtimes, it is a part of their Observational learning *or* social learning *process*, which refers to the natural human inclination to observe and imitate the behaviors of others (Bandura, 1977)

(17). Premastication of solid food will not last forever. There must be a point after which the process stops. This point is set by overcoming the anatomical and physiological obstacles. The surveyed nursing mothers claimed that they stop masticating food when the children's teeth grow i.e. they feel the child is old enough to chew the food him/ herself. Usually children develop the molars they need to chew most foods at the age of 18 to 24 months. Many mothers see this is the suitable time to stop premastication and let the child self-depend regarding chewing their food. So premastication of food starts at the age of six months and ends at 18 months in the average. This finding in agreement with findings by Conkle et. al (18).

Regarding the nature of social relations in Sudan and the existence of an extended family, we are not surprised that other members of the family are involved in feeding the infant via premastication. The grandmothers participate in masticating food, the child's fathers, and other family members, including the elder siblings.

This finding is concurring with results of study done in Laos by Holmes and others. It is noteworthy that females in the family premasticate more than males. It is because they care for children in our societies (19).

The food is often premasticated and then placed, frequently with dirty hands, directly in the infant's mouth. In resource-limited areas where clean water and children's formula cannot be easily obtained. Especially in mothers who suffer from gingivitis and poor dental hygiene in general, it is likely to mix bacteria, blood and saliva with masticated food. Transmission of infectious gastric particles by food bolus in the immature intestine of a child has been linked to the transmission of HIV from infected mothers to their offspring, which may also be enabled, by concurrent intestinal infection and malnutrition (5, 20, 21, 22). However, Barron confirms that there is little possibility of transmitting HIV via saliva due to the small percentage of its presence in the saliva of a person who carries HIV. According to him, we can consider the transmission of HIV by premasticated food is a rare occurrence (23). Yet, nursing mothers with HIV are advised against feeding their children premastication food.

Belto and many other scientists believe that the method of feeding involves the

process of building the immune system that begins with breastfeeding. By exposing infants to the effects of pathogens present in the mother's saliva, it prepares to produce antibodies, and teach their immune systems how to deal with the same pathogens later. It may also prevent the onset of autoimmune diseases, such as asthma, that are very common in industrialized societies. Belto and colleagues linked this suggestion to underexposure to diseases during childhood (24).

Nevertheless, within the realms of the new worldwide epidemic, Covid-19 virus, which was first, reported late December of 2019 and has caused a global outbreak. It is well known that its main route of transmission is through respiratory droplets, but also salivary glands and tongue are possibly avid hosts of Covid-19 (Xu, R ,2020) (25). Saliva has been reported nucleic acid positive and considered a primary mode for viral dissemination by World Health Organization (26). That means pre-mastication offers an easy and a fast way to transmit the infectious salivary droplets to the infant's mouth Covid19 enters host cells via cell receptor ACE II (ACE2) and the transmembrane serine protease 2 (TMPRSS2). ACE2 and TMPRSS2 were found highly expressed in the esophagus, upper epithelial gland cells and in the absorptive enterocytes

from the ileum and colon (Zang) (27). Such findings lead to the conclusion that during the epidemic pre-mastication can potentially be a hazardous habit.

Conclusion:

Our study found a low proportion of pre-mastication among the nursing mother in the study area, despite the high rates of the phenomenon in different regions of the world. We do not think that the low rate here is an underestimation, but it is an actual decrease in the levels of the phenomenon. We attribute this decrease to the spread of education and awareness of healthy behaviors of children's raising, the spread of modern food grinding methods, and the availability of mashed food alternatives in the market.

Although there are some benefits associated with the process of pre-mastication of food, this decline is a good indication of lessening the potentiality of transmitting certain diseases from infected mothers (or anybody else) to the offspring.

As prevention of Covid-19 infection is one of the priorities of global health systems, we recommend that a health strategy should be developed to prevent pre-mastication in highly practiced areas during these periods.

Limitations:

If we had conducted this study in a rural area, it would have been possible to obtain results other than those obtained. The study was unable to relate the phenomenon of premastication of food to other factors such as education level and socioeconomic status of participants.

Acknowledgement:

We would like to express our gratitude to the teaching assistants from Alzaiem Alazhari University and other universities who contributed significantly to collecting data for this study. Our gratitude extends to Dr. Elshibli Mohamed Who analyzed the data and helped shaping the tables.

Conflict of interest: The authors declare that they do not have conflict of interest

Funding: This study was funded by generous fund by the Ministry of Higher Education and Scientific Research, 2017 - 1

References:

- [1] Goldman AS. The immune system of human milk: antimicrobial, anti-inflammatory and immunomodulating properties. *Pediatr Infect Dis J* 1993; 12. 664–71.
- [2] Goldman AS, Garza C, Nichols BL, Goldblum RM. Immunologic factors in human milk during the first year of lactation. *J Pediatr* 1982; 100. 563– 7.
- [3] Salih MA, el Bushra HM, Satti SA, *et al.* Attitudes and practices of breast-feeding in Sudanese urban and rural communities. *Trop Geogr Med.* 1993; 45. 171-4.
- [4] Bădescua, I, Sicotte, P, Sandel AA, *et al.* Premasticated food transfer by wild chimpanzee mothers with their infants: Effects of maternal parity, infant age and sex, and food properties. *Journal of Human Evolution.* 2020; vol. 143 102794. <https://doi.org/10.1016/j.jhevol.2020.102794>
- [5] Radbill SX. Infant feeding through the ages. *Clin Pediatr* 1981; 20: 613-21.
- [6] Hennart P, Vis HL. Breastfeeding and post-partum amenorrhea in Central Africa. *J Pediatr* 1980; 26:177-83.
- [7] Gaur AH, Dominguez KL, Kalish ML, *et al.* Practice of feeding premasticated food to infants: a potential risk factor for HIV transmission. *Pediatr* 2009; 124. 658-66.
- [8] Imong SM, Jackson DA, Rungruengthanakit K, *et al.* Maternal behaviour and socio-economic influences on the bacterial content of infant weaning foods in rural

- Northern Thailand. *J Trop Pediatr* 1995; 41. 234-40.
- [9] Qureshi H, Hafiz S, Medhi I. H. pylori IgG antibodies in children. *J Pak Med Assoc* 1999; 49. 143-4.
- [10] Neander WL, Morse JM. Tradition and change in the Northern Alberta Woodlands Cree: implications for infant feeding practices. *Can J Public Health* 1989; 80. 190-4.
- [11] Fawzi WW, Herrera G M, Nestel P E *et al.* A longitudinal study of prolonged breastfeeding in relation to child undernutrition. *International Journal of Epidemiology* 1998; 27. 255---60
- [12] CDC. Premastication of Food by Caregivers of HIV-Exposed Children. Morbidity and Mortality Weekly Report. 2011 / 60. 273-5
- [13] Pelto, G. H., Zhang, Y, & Habicht, J. P. Premastication: The second arm of infant and young child feeding for health and survival? *Maternal & Child Nutrition*, 2009; 6. 4– 18.
- [14] Le Révérend, B. J., Edelson, L. R., & Loret, C. Anatomical, functional, physiological and behavioural aspects of the development of mastication in early childhood. *The British Journal of Nutrition*; 2017; 111. 403– 14. <https://doi.org/10.1017/S0007114513002699>
- [15] de Sa, J., Bouttasing, N., Sampson, L *et al.*, A. Identifying priorities to improve maternal and child nutrition among the Khmu ethnic group, Laos: A formative study. *Maternal & Child Nutrition*. 2013; 9. 452– 66. <https://doi.org/10.1111/j.1740-8709.2012.00406.x>.
- [16] Jones S. W, Lee M, Brown A. Spoonfeeding is associated with increased infant weight but only amongst formula-fed infants. *Matern Child Nutr.* 2020; <https://doi.org/10.1111/mcn.12941>
- [17] Bandura A. (1977). Social Learning Theory. Englewood Cliffs, NJ: Prentice-Hall
- [18] Conkle J, Kounnavong S, Young M, Stein AD. Premastication and length for age among children under 24 months in Laos. *Matern Child Nutr.* 2017; vol. 14. e12456. <https://doi.org/10.1111/mcn.12456>
- [19] Holmes, W., Hoy, D., Lockley, A., *et al.* Influences on maternal and child nutrition in the highlands of the northern Lao PDR. *Asia Pacific Journal of Clinical Nutrition*, 2007; 16. 537– 45.
- [20] DiNubile M J. Premastication: A Possible Missing Link? *Clinical Infectious Diseases*. 2010; Vol. 51.

- 252–3,
<https://doi.org/10.1086/653681>
- [21] Wojcicki, J. Traditional behavioural practices, the exchange of saliva and HHV-8 transmission in sub-Saharan African populations. *Br J Cancer* 89, 2016–2017 (2003). <https://doi.org/10.1038/sj.bjc.6601390>
- [22] Gonzalez OA, Ebersole JL, Huang CB. Oral infectious diseases: a potential risk factor for HIV virus recrudescence? *Oral Dis.* 2009; vol. 15. 313 -27.
- [23] Samuel Baron. Oral Transmission of HIV, a Rarity: Emerging Hypotheses. *J Dent Res.* 2001; vol. 8. 1602-4.
- [24] Pelto GP Goodman AH & Dufour DL. The Biocultural Perspective in Nutrition Anthropology. In: Goodman AH, Dufour DL and Pelto GH eds.), *Nutritional Anthropology: Biocultural Perspectives on Food and Nutrition.* Mayfield, pp 1-10.
- [25] Xu R., Cui B., Duan X, *et al.* Saliva: potential diagnostic value and transmission of 2019-nCoV. *Int J Oral Sci;* (2020). <https://doi.org/10.1038/s41368-020-0080-z>
- [26] WHO. Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus https://www.who.int/health-topics/coronavirus#tab=tab_1
- [27] Zhang H, Kang Z, Gong H, Z *et al.* Digestive system is a potential route of COVID-19: an analysis of single-cell coexpression pattern of key proteins in viral entry process. *BMJ.* 2020; Vol. 69 <https://gut.bmj.com/content/69/6/1010>