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EVALUATION OF THE INFANT AND YOUNG CHILD FEEDING INDEX AMONG MOROCCAN CHILDREN

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ABSTRACT

Background. Several investigations worldwide have scrutinized the ability of the infant and young child feeding index (**ICFI**) in evaluating the child-feeding practices and their correlation with children's nutritional status. **Methods**. Grounded in the feeding index concept, as laid out by Ruel and Menon in 2002, a cross-sectional ICFI was set-up and the variables were rated in 297 aged 6-24-mo-old Moroccan children from Casablanca. The relation between ICFI and Weight-for-age Z-scores (WAZ), Length-for-age Z-scores (LAZ) and Weight-for-Length Z-scores (WLZ) was assessed using anthropometric data. The data obtained were analyzed using a nonparametric Kruskal-Wallis H test, post hoc Mann-Whitney U-test, and Bonferroni correction. **Results**. In our survey, a significant interaction was observed between LAZ and the total ICFI ($p<0.001$) in virtually all age groups. Whereas, a link has been objectified between WLZ and ICFI only for children aged 6-8 months ($p<0.001$), and further, WAZ and ICFI considering the 9- to 11-mo-old as well as the 12- to 24-mo-old age groups. **Conclusions**. These findings are in line with previous observations by Ruel and Menon and numerous surveys documented in evidence-based literature that supported the positive contribution of child feeding practices on child growth by using the ICFI.

Keywords: Breast-feeding, Complementary feeding, Food security, Infant and Child Feeding Index, Nutritional status.

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INTRODUCTION

The all-inclusive concept of food security in the developing countries refers notably to attaining a qualitative dimension of a healthy diet that does not induce health threats for children and adults. In recent decades, food policy in the Middle East and North Africa (MENA) emphasized on food security challenges in the region. Due to the large geographical, climatic, economic system, and natural resource based variations in the region there is not one food policy that suits all the countries in the region [1].
Child malnutrition is encompassing both under-nutrition and overweight, which are extensive affections with major consequences for survival, incidence of acute and chronic diseases, healthy development, and economic productivity of individuals and communities [2].With this in mind, considerable reports have led to an expanded focus on nutrition in the first thousand days of a child's life when exposure to nutritional threats is greatest, and on that account so is the opportunity for targeted interventions to have substantial outcomes [3 - 6].Besides, it has been settled that a fall in under-five mortality have been widely justified by the increase in coverage of child-focused interventions and readjustments of children's nutritional status [7].
On the other hand, according to the World Health Organization (WHO), breast milk is recognized as the only food that could exclusively provide all the nutrients recommended for reinforcing optimal

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growth in early infancy [8-11]. Thereafter, from the age of 6 months onwards, children require a flawless diversified diet to supply the quantities of nutrients required to guarantee adequate growth. Impaired feeding in the first years of life might induce malnutrition, which has been established to be correlated to short-term injurious repercussions, essentially retarded growth and increased child morbidity and mortality in addition to raised peril of adult Non-Communicable Diseases [8, 12].

In recent times, universal guideswere enriched regarding distinct features of complementary feeding, such as the optimal number of meals per day and age at introduction of foods specifically intended for infants [9, 10]. Hence, practical feeding index is greatly needed in estimating the caregiver's feeding behaviours and the infant and young child's diet quality and quantity. Consequently, infant and child feeding practices have drawn a great deal of attention for years and then been assessed with the application of a summary index as documented in scientific literature. Ruel and Menon played the role of leaders in constructing an age-specific infant and child-feeding index (ICFI) based on the recommended beneficial feeding practices in developing countries and on fundamental indicators disclosed by WHO and its connection with nutritional status of young children[13, 14].

Ruel and Menon [13] demonstrated a significant positive association between the ICFI and child Length-for-age Z-score (HAZ) in Latin American countries. Different studies have been conducted afterwards to examine the application of ICFI at international scales, and to test the association between ICFI and child nutritional status. The results from those studies varied remarkably, which may be elucidated by the divergences in socio-economic and cultural context, children's age and their former nutrition conditions [15-21].

The current study is exploiting data from a cross-sectional research design carried on in an urban community from the metropolitan area of Casablanca, Morocco, to explore the feeding practices among children below 2 years as well as the application of ICFI in the Moroccan context with a view to figure out its relationship with child nutritional status.

SUBJECTS AND METHODS

Study setting

Based on the data of the Moroccan General Census of Population and Housing (RGPH) of 2014 [22], the prefecture of Aïn Chock District consists of 89 013 households with a total population of 377 744.

Study design

We carried out a cross-sectional study of food consumption and anthropometric measurement from January to December 2016 at the health centers in Aïn Chock district, Casablanca.

A face-to-face interview was conducted with mothers using a structured questionnaire to get information on dietary, healthcare and socio-demographic data.

Sampling

The survey was conducted among children aged 6-24 months and their mothers coming for vaccination or vitamin A / D supplementation for their children. Those having any congenital or metabolical diseases influencing growth, history of acute infection or diarrhea 15 days or less prior to the survey were excluded.

Data collection

1 Infant and child feeding index

Infant and child feeding practices were assessed through a qualitative 24-h recall of food frequency data and all foods consumed the previous day: breast-feeding, bottle-feeding, number of meals and snacks, and exact composition of the meals ingested. Practices were considered positive or negative on the basis of current child feeding recommendations [13].

On the basis of the information gathered, the score of diversification of Ruel and Menon was applied to the population surveyed. To take into account the age limits of feeding recommendations, the ICFI was compiled separately for the 3 age groups: (6-8), (9-11) and (12-24) months, successively.

Current breast-feeding received a score of "+2" and a score of 0 was given to non-breastfeeding children at all ages. Banishment of baby bottles was scored +1 (good practice) and their use received a score of 0 throughout the age range included [13].

Variety of food groups was assessed using semiquantitative recalls with the mother. The method proposed by Ruel and Menon takes into account food diversity indices calculated both over the last 24 h and over the last 7 days.

For all age groups, dietary diversity (the sum of different food groups received during 24 hours preceding the survey) scoring used is as follows: none (meaning no solid foods) was given a score of "0", One point was given if the child consumed 1 to 3 food groups on the day preceding the survey out of the total of 4 main groups — Fishes / meats / eggs— cereals/ seeds / beans / roots /tubers — Fresh fruit / vegetable — Animal milk and dairy

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products other than the maternal milk, for children beyond 12 months; +2 points were given if 4 or more food groups were consumed [13, 23, 24].

Food frequency is the average food of the same group received in the previous week. Each food group was scored individually and the scores for each one were summed to determine a final food-frequency score. Animal products were scored "0" if they were not consumed during the past week, "+1" if they were consumed on 1-3 days, and "+2" if they were consumed on 4 or more days. Staple foods received a score of "+2" if consumed 3 days in the previous week at 6-8 and9-11 months of age. The score of"+1" if they were consumed once in the previous week at 6-8, 9-11 months of age and 3 days at 12-24 months of age. They were scored "0" otherwise. The milk group was not included in the food frequency score for infants up to 12 months of age. For children ≥ 12 months old, all three animal food groups (milk, meat, fish/egg/poultry) were included and a score of "+2" was given for each when consumed 4 days/week or more [13].

For meal frequency scores (how many times the child was offered solid foods in the previous 24 h), +2 points were added if the recommended meal frequency was reached, and 1 point was added if the meal frequency did not meet the recommendations. It was scored "0" if the meal frequency is once the day preceding the survey or less. For snacks such as fruits, +1 point was given if the child consumed snacks at least twice on the day before the survey [13].

The final child feeding index was a sum of the scores obtained for each variable described above. In the analyses, within each age group, the index was used after recoding in terciles (poor, average, and good levels of feeding practices) for the analysis of variance: low ICFI (between 2 and 8), average ICFI (between 9 and 10), high ICFI (upper to 10) [13].

The global ICFI score internal consistency was tested using different statistical techniques: (1) By testing the associations between ICFI and each of its core components through chi-square tests, and (2) by computing the Cronbach α coefficient to define the interrelatedness of item scores. The α-value higher than 0.7 is generally defined to be adequate [25].

2 Anthropometry

Weight and Length were obtained according to WHO procedures. The children weight and length were used to compute age-and gender-specific z-scores so as to derive underweight, wasting, and stunting [26]. The overall child nutritional status outcome used was [27]:

- Weight-for Length Z-score (s) (WLZ)
- Weight-for-age Z-score(s) (WAZ),
- Length-for-age Z-score(s) (LAZ)

Children were classified into various grades of nutritional status based on the WHO criteria. Under-nutrition; corresponding to anthropometric parameters less than 2 standard deviations (SD) of the WHO growth's standards, Stunting was defined as LAZ being less than the Z score cut-off of -2. Underweight and wasting were defined by the WAZ and WLZ score cut-off of -2, respectively [26].

To explore the association between ICFI categories and mean anthropometric indices, potential confounding factors, that can influence both the ICFI value and the children's nutritional status, were distinguished on the basis of the acknowledged UNICEF conceptual model of the causes of malnutrition [28].

3 Demographic, socio-economic *and health context*

Data for each child: Child's age and gender were collected. Morbidity during the fortnight prior to the survey was recorded.

Data for each mother: Maternal age, matrimonial status, level of education (illiterate, primary, secondary, higher), mode of delivery and occupational status were collected.

Data for each household: To define the middle, the poor and the wealthy social classes in Morocco in terms of income per household per month, a broad definition of the middle class is retained by the High Planning Commission which is based on a lower limit of 0.75 times the median (i. e. 2800 Moroccan dirham (MAD) per month) and an upper limit of 2.5 times the median (i. e. 6736 MAD per month). For the delimitation of the middle class in Morocco in terms of monthly consumption expenditure, the lower limit is 2848 MADper month and the upper limit is 6850 MAD per month [29].

Supplementary collected variables included the number of people living in the household and education level of the head of household. The hygiene practices within the household were also assessed by gathering information on water, standard of living index, and some potential economic status indicators like the quality of housing.

4 Statistical *Analysis*

IBM SPSS Statistics software version 21 was used for data analysis.
Categorical variables are presented as frequency and percentage. Continuous variables are presented as mean ± SD, median, inter-quartile range (IQR), and range. A significance threshold p-value of 0.05 was adopted for all statistical analyses.
Normality assumption was evaluated by the Kolmogorov-Smirnov and Shapiro-Wilk tests but rejected at a p-value of <0.05. As the parametric assumptions were not satisfied, a Kruskal-Wallis H test was conducted. If statistically significant differences were found among groups, Mann-Whitney U-tests with Bonferroni correction were appliedfor nonparametric nominal data (adjusted p-value=0.016) [30]. Groups were also compared using Chi-Square test for categorical variables, along with Fisher's least significant difference (LSD) test.
Multivariate regression analysis was carried out to determine whether selected maternal and child characteristics were linked with ICFI. The variables entered in the equation were maternal age, education, socio-economic level.

5 Ethics

This study has been reviewed and received ethics clearance through the Institutional Research Ethics Board of the Faculty of Medicine in Rabat, Mohamed V University, Morocco. The interview content was described thoroughly to potential respondents, and informed verbal consent was obtained before beginning the interviews with the mothers.

RESULTS

Sample characteristics

The total number of apparently healthy children, with no previous known medical conditions, enrolled in the analysis was 297, with 57.2% being males and 42.8 % being females. The mean mothers's age was 29.7±6 years (range: 17-48). The mean age of the children was 13.01±5.3months (range: 6-24).
The majority of the interviewees were married mothers (98.3 %) with fertility rates close to the two-child average (SD=1.05).Vaginal delivery in hospital was reported in 58 % of the cases. With regard to birth-order, which refers to the order a child is born in their family, first-borns and second-borns represented 74.4 % of the total surveyed population.
The main sample socio-demographic characteristics are described in Table I.

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Table I: Socio-demographic characteristics of infants and families (N=297).

Characteristics	Frequency n (%)	Mean (SD)	Median (IQR)
Child's age			
6-8 months	58 (19.5)	6.9 (±0.8)	7(6-8)
9-11 months	83(28)	9.4 (±0.7)	9(9-10)
12-24 months	156(52.5)	17.2 (±3.8)	18(14-19)
Gender of the child			
Female	127(42.8)	-	-
Male	170(57.2)	-	-
Primary caregiver characteristics			
Mother's age			
Less than 20 Years	11(3.7)	18.5 (±0.8)	19(18-19)
20-29 Years	146(49.2)	25.6 (±2.5)	26(24-28)
30-39 Years	117(39.4)	33.7 (±2.8)	33(31.5-36)
40-49 Years	23(7.7)	41.4 (±2.1)	41(40-42)
Mother's literacy status			
None	27 (9.1)	-	-
Primary school	56 (18.9)	-	-
Secondary school	177 (59.6)	-	-
Higher education	37 (12.5)	-	-
Mother's occupation			
Housewife	259 (87.2)	-	-
Paid worker	38 (12.8)	-	-
Head of household characteristics (The father in 98% of the cases)			
Paternaleducation			
None	10 (3.4)	-	-
Primary school	18 (6)	-	-
Secondary school	213 (71.7)	-	-
Higher education	56 (18.9)	-	-
Father's occupation			
Paid worker	276(92.9)	-	-
Unemployed	21(7.1)	-	-
House hold characteristics			
People in household			
1–6	247 (83.2)	4.12 (±0.98)	4 (3-5)
7–10	42 (14.1)	7.67 (±0.98)	7 (7-8)
≥11 persons	8 (2.7)	12.9 (±1.6)	12.5 (11.25-14.75)
Monthly income (MAD)	297 (100)	4721.6(±1713.4)	5000 (2700-6500)
House hold economic level			
Low	83 (27.9)	-	-
Medium	214 (72.1)	-	-
Connection to central sewer networks and sanitation facilities			
Yes	270 (90.9)	-	-
No	27 (9.1)	-	-
Safe source of drinking water			
Yes	280 (94.3)	-	-
No	17 (5.7)	-	-
Quality of housing			
Cement	247 (83.2)	-	-
Slum	50 (16.8)	-	-

SD=Standard Deviation; IQR= Interquartile Range ; MAD = Moroccan dirham

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Breastfeeding practices

When first enrolled in the study, 76.4 % of the children were still breastfed (n=227) and 38 % were bottle-fed (n=113). Offering the breast to newborns within the first hour of birth was reported among 94.9 % of the mothers, among which 4 % of the women, who have just given birth, put breast milk in the baby bottle. Nevertheless, breastfeeding did not last into the second half year of childhood. At baseline, the proportion of infants who began to consume a mixed feeding from birth was 39.4 %.

The socio-professional structure of households

The regular occupation of child's father is a workman in 51.2 % of the cases, an administrative officer (27.6%) and merchant (18.2%). The number of housewives (87.2%) is more than 7 times the number of those who are in employment and who have a disposable monthly income (12.8 %) (Table I).

The composition of social classes and the structure of household income

On average, 72% of our population (n=214) is belonging to a middle class with a median monthly income of 6000 MAD (Interquartile range: 5000-6500 MAD) and an average expenditure on the consumption in the amount of 5124MAD per month.

Furthermore, 28% of the households (n=83) have a median monthly income of 2600 MAD (IQR: 2500-2700 MAD), with average consumption expenditure amounted to 1824 MAD per month; this household category belongs to the poor class.

Living conditions of households

Nearly 99 % of our sample lives in urban areas. Almost 98.3 %of the households have access to electricity. In most instances, study participants had health insurance. However, in11.8 % of the cases, no health insurance coverage is offered to them which interfere with a fairly use of health services.

Nutritional status

The overall anthropometric description of the children at the moment of recruitment is depicted in table II.

Table II: Global anthropometric description of the children surveyed.

Anthropometric Variables	Overall (N=297)	Mean (SD)	25th Percentile	Median (50th Percentile)	75th Percentile
Weight (Kilograms)	297	10.2 (1.9)	9	10	11.5
Weight (Z-scores)	297	0.5 (1.3)	-0.5	0.5	1.5
Child's size (Centimetres)	297	74.2 (7.3)	69	73	80
Child's size (Z-scores)	297	0.14 (1.8)	-1	0	1.5
Body Mass Index (BMI) (kg/m2)	297	18.5 (2.9)	16.5	18.3	20.3
Length-for-age (Z-scores)	297	-0.4 (1.9)	-2	-0.5	1
Weight-for-age (Z-scores)	297	0.3 (1.3)	0.5	0	1
Weight-for Length (Z-scores)	297	0.9 (1.5)	0	1	2
BMI-for-age (Z-scores)	297	0.9 (1.5)	0	1	2

Additionally, 47 infants (15.8 %) were stunted (LAZ<-2 SD) and 36 children (12.1%) severely stunted (LAZ<-3 SD). Ten infants (3.4%) were wasting (WLZ<-2 SD) and four ones (1.3%) were severely wasted (< -3 SD) (table III). Besides, the rate of overweight (WLZ>+2 SD) of infants were 22% over the study period.

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Table III: Nutritional status classification based on growth indicators (z-scores), (at all ages)

	LAZ		WAZ		WLZ	
	Nutritional status	n(%)[a]	Nutritional status	n(%)	Nutritional status	n(%)
Growth Indicators Less than -2 Z-scores	Severely Stunted (< -3 Z-score)	36 (12.1%)	Severely Underweight (< -3 Z-score)	5 (1.7%)	Severely Wasted (< -3 Z-score)	4 (1.3%)
	Stunted (< -2;> -3 Z-score)	47 (15.8%)	Underweight (< -2;> -3 Z-score)	20 (6.7%)	Wasted (< -2;> -3 Z-score)	10 (3.4%)
	Combined	83 (27,9%)	Combined	25 (8.4%)	Combined	14 (4.7%)
Median	-2.5		-2		-2.5	
IQR	(-3;-2)		(-2.5;-2)		(-3;-2)	

[a] Prevalence %, LAZ=Length-for-age z-score; WAZ=Weight-for-age z-score; WLZ=Weight-for-length z-score; IQR= Interquartile Range

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With reference to LAZ, WLZ and WAZ, the mean z scores were not significantly better among children beyond 12 months than the younger children (p=0.467; p=0.946; p=0.968, respectively).

ICFI Score

Evaluation of the ICFI internal validity

As evaluated by chi-square tests, in all age groups, the ICFI was strongly associated with breast-feeding (p<0.001), bottle-feeding (p<0.001), dietary diversity score (p<0.001), food variety score (p<0.001) and meal frequency score(p<0.001).The ICFI internal consistency estimated by the Cronbach α coefficient (Table IV) has proven to be satisfactory among children in all age groups.

Table IV: Study of internal reliability by Cronbach α coefficient

	6-8 mo (n=58)		9-11 mo (n=83)		12-24 mo (n=156)		Overall (N=297)	
α Value [b] for ICFI (all Items)	0.90		0.86		0.88		0.88	
Items	Corrected item-total Correlation with ICFI	αValue	Corrected item-total Correlation with ICFI	α Value	Corrected item-total Correlation with ICFI	α Value	Corrected item-total Correlation with ICFI	αValue
Breastfeeding	0.85	0.87	0.83	0.80	0.91	0.81	0.87	0.82
Bottlefeeding	0.73	0.89	0.59	0.85	0.63	0.87	0.64	0.87
DDS	0.64	0.90	0.57	0.86	0.64	0.87	0.62	0.87
FVS	0.82	0.87	0.76	0.81	0.73	0.85	0.76	0.84
MFS	0.90	0.87	0.75	0.82	0.83	0.84	0.82	0.84

[b] An α value upper to 0.7 is considered to be acceptable;
DDS: Dietary Diversity Score; FVS: Food Frequency Score; MFS: Meal Frequency Score.

Components of ICFI

The median ICFI score of all the children surveyed was 9 (IQR: 7-9.5). Table V shows the ICFI component distribution by age group and the percentage of children who were fed from the 4 main food groups.

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Table V: Distribution of children for the different ICFI components by age category

ICFI/ Components	Groups	6–8 mo n=58	9–11 mo n=83	12–24 mo n=156	p value
		Overall (N=297)			
Breast-feeding (Current)	**Yes**	45(77.6%)	65(78.3%)	117(75%)	0.825
	No	13(22.4%)	18(21.7%)	39(25%)	
Bottle-feeding (Since birth)	**Yes**	21(36.2%)	31(37.3%)	61(39.1%)	0.917
	No	37(63.8%)	52(62.7%)	95(60.9%)	
Dietary diversity [1] (Number of food groups. 24-h recall)					
Low	**0**	7(12.1%)	8(9.6%)	21(13.5%)	
Medium	**(1–3)**	35 (60.3%)	49(59%)	78(50%)	0.547
High	**(≥4)**	16(27.6%)	26(31.3%)	57(36.5%)	
Food Variety Score [2]					
Frequency of Consuming fish/meat/eggs (Times/Week)					
Low	**0**	16(27.6%)	16(19.3%)	30(19.2%)	
Medium	**(1–3)**	35(60.3%)	60(72.3%)	112(71.8%)	0.556
High	**(≥4)**	7(12.1%)	7(8.4%)	14(9%)	
Frequency of Consuming staple foods (Times/Day)					
Low	**(<1)**	15(25.9%)	17(20.5%)	41(26.3%)	0.005**
Medium	**(1-2)**	38(65.5%)	54(65.1%)	112(71.8%)	
High	**(≥ 3)**	5(8.6%)	12(14.5%)	3(1.9%)	
Frequency of Consuming fruits/vegetables (Times/Day)					
Low	**0**	14(24.1%)	18(21.7%)	36(23.1%)	0.827
Medium	**1**	38(65.5%)	59(71.1%)	110(70.5%)	
High	**(≥ 2)**	6(10.3%)	6(7.2%)	10(6.4%)	
Meals Frequency Score (24-h recall)					
Medium	**1**	15(25.9%)	23(27.7%)	45(28.8%)	0.909
High	**(≥ 2)**	43(74.1%)	60(72.3%)	111(71.2%)	
Child feeding index					
Median (IQR)		9 (5.5-9)	9(7-10)	9(5.25-10)	0.911
Low score	**(2-8)**	17(29.3%)	22(26.5%)	45(28.8%)	0.840
Average score	**(9-10)**	35(60.3%)	55(66.3%)	102(65.4%)	0.495
High score	**(>10)**	6(10.3%)	6(7.2%)	9(5.8%)	0.311

**** Fisher's least significant difference test (p<0.01); [1]Food groups: Fishes / meats / eggs— cereals/ seeds / beans / roots /tubers — Fresh fruit / vegetable — Animal milk and dairy products other than the maternal milk;[2] The scores for each food group were summed to derive a final food-frequency score.**

The comparison of median scores for each component between age groups and by gender is illustrated in Table VI.

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TableVI: Scores of ICFI and its components compared between age groups and by gender

ICFI Components Scores	6–8 mo (n=58)			9–11 mo (n=83)			12–24 mo (n=156)		
	Overall (N=297)								
	Boys (n=35)	Girls (n=23)	p value	Boys (n=52)	Girls (n=31)	p value	Boys (n=83)	Girls (n=73)	p value
	n (%)	n (%)		n (%)	n (%)		n (%)	n(%)	
Breast feeding (Current)									
Yes	28 (48.3)	17 (29.3)	**0.587**	37 (44.6)	28 (33.7)	**0.40**	57 (36.5)	60 (38.5)	**0.052**
No	7 (12.1)	6 (10.3)		15 (18.1)	3 (3.6)		26 (16.7)	13 (8.3)	
Bottle feeding (Since birth)									
Yes	14 (24.1)	7 (12.1)	**0.458**	24 (28.9)	7 (8.4)	**0.032***	38 (24.4)	23 (14.7)	**0.068**
No	21 (36.2)	16 (27.6)		28 (33.7)	24 (28.9)		45 (28.8)	50 (32.1)	
Dietary Diversity (Past 24 H)									
Low	3 (5.2)	4 (6.9)	**0.500**	7 (8.4)	1 (1.2)	**0.384**	17 (10.9)	4 (2.6)	**0.022***
Medium	21 (36.2)	14 (24.1)		29 (34.9)	20 (24.1)		37 (23.7)	41 (26.3)	
High	11 (19)	5 (8.6)		16 (19.3)	10 (12)		29 (18.6)	28 (17.9)	
Food Variety Score									
Frequency of Consuming Fish/Meat/Eggs (Times/Week)									
Low	10 (17.2)	6 (10.3)	**1**	13 (15.7)	3 (3.6)	**0.155**	20 (12.8)	10 (6.4)	**0.020***
Medium	21 (36.2)	14 (24.1)		36 (43.4)	24 (28.9)		52 (33.3)	60 (38.5)	
High	4 (6.9)	3 (5.2)		3 (3.6)	4 (4.8)		11 (7.1)	3 (1.9)	
Frequency of Consuming Staple Foods (Times/Day)									
Low	9 (15.5)	6 (10.3)	**0.765**	14 (16.9)	3 (3.6)	**0.174**	28 (17.9)	13 (8.9)	**0.010****
Medium	22 (37.9)	16 (27.6)		31 (37.3)	23 (27.7)		52 (33.3)	60 (38.5)	
High	4 (6.9)	1 (1.7)		7 (8.4)	5 (6)		3 (1.9)	0 (0)	
Frequency of Consuming Fruit/Vegetable									
Low	8 (13.8)	6 (10.3)	**0.774**	15 (18.1)	3 (3.6)	**0.047***	26 (16.7)	10 (6.4)	**<0.001**
Medium	24 (41.4)	14 (24.1)		35 (42.2)	24 (28.9)		48 (30.8)	62 (39.7)	
High	3 (5.2)	3 (5.2)		2 (2.4)	4 (4.8)		9 (5.8)	1 (0.6)	
Meals Frequency (24-h recall)									
Low	0 (0)	0 (0)	**0.519**	0 (0)	0 (0)	**0.069**	0 (0)	0 (0)	**0.032***
Medium	8 (13.8)	7 (12.1)		18 (21.7)	5 (6)		30 (19.2)	15 (9.6)	
High	27 (46.6)	16 (27.6)		34 (41)	26 (31.3)		53 (34)	58 (37.2)	
Child Feeding Index									
Low score	10 (17.2)	7 (12.1)	**0.855**	19 (22.9)	3 (3.6)	**0.017***	30 (19.2)	15 (9.6)	**0.003****
Average score	22 (37.9)	13 (22.4)		30 (36.1)	25 (30.1)		45 (28.8)	57 (36.5)	
High score	3 (5.2)	3 (5.2)		3 (3.6)	3 (3.6)		8 (5.1)	1 (0.6)	

***p<0.05; **p<0.01.**

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The median scores for some ICFI components differed significantly between age groups and by gender: The bottle-feeding scores (p =0.032) and the frequency of consuming fruits and vegetables scores (p=0.047) for children aged 9–11 months.

Concerning children aged 12–24 months, the dietary diversity (p=0.022), the meal frequency (p=0.032), the frequency of consuming fruits and vegetables (p<0.001), the frequency of consuming fish/meat/eggs (p=0.020), the frequency of consuming staple foods (p=0.010) scores, differed significantly between age groups and by gender.

Breastfeeding was found to have an important impact, as breast fed children had significantly higher ICFI scores than non-breastfed children between age groups (p<0.001) and also by gender (p<0.001).There was significant interaction between breastfeeding status and age category; with respect to the three age groups, there was significant interaction between breast feeding and mean ICFI scores (p<0.001; p<0.001; p<0.001, successively).In addition, the interaction between gender of the child, breastfeeding and the ICFI total scores between age categories was statistically significant for children (p<0.001).

With reference to the ICFI total scores, statistically significant gender difference was found for children aged 9-11 months (p=0.017) and for those aged 12–24 months (p=0.003). No significant gender difference was observed in the ICFI total scores for children below 9 months of age (p=0.855).

A multiple regression analysis (step-wise method) was performed using the scores of the five main ICFI components as independent variables and total ICFI score as the dependent variable. The variables were entered in the model in following order: breastfeeding score, Food Variety score, meal frequency, DDS and bottle-feeding score. All the five components were found to be significant, with breastfeeding score (Beta = 0.400, p<0.001) and FVS (Beta = 0.226, p<0.001) contributing the most to the total ICFI score followed by meal frequency score (Beta = 0.212, p<0.001), DDS (Beta = 0.190, p<0.001) and bottle feeding score (Beta = 0.124, p<0.001).

Association of ICFI with the children nutritional status

The growth indicators z-scores by age categories and ICFI categories were examined. The Kruskal-Wallis test yielded a significant difference between mean LAZ scores in the low, medium and high categories of ICFI across all the age groups. Post-hoc pairwise comparison, applying Mann-WhitneyUtest with Bonferroni correction, showed statistically significant differences for LAZ scores; between low-high ICFI categories (P<0.001), and between low-medium ICFI categories (P<0.001). However, no statistically significant differences were detected in LAZ scores between medium and high ICFI groups, across the three age groups (p=0.896, p=0.094, p=0.559; subsequently).

For infants less than 9 months, there was additionally a significant association between the ICFI and WLZ scores (p<0.001). But no significant interaction was found between WAZ scores and ICFI (p=0.262). The Post-hoc pairwise comparisons analysis by Mann-Whitney U test revealed statistically significant differences in WLZ scores between low-medium ICFI categories (P<0.001), and between low-high ICFI categories (p=0.008). No difference was found in WLZ scores between medium and high ICFI (p=0.787).

For children aged 9-11 months, there was a significant association between the mean ICFI and LAZ scores (p<0.001) and WAZ scores (p<0.001). Paradoxically, no significant correlation was found between WLZ scores and ICFI (p=0.807). The Post-hoc pairwise comparisons analysis showed a statistically significant difference in WAZ scores between low-medium ICFI categories among the 9- to 11-mo-old age group (P<0.001).

With regards to children aged 12–24 months, a statistically significant association was found between the mean ICFI and LAZ scores (p<0.001) and WAZ scores (p=0.001). But no significant correlation was found between WLZ scores and ICFI (p=0.063).

A significant relationship was objectified between LAZ and all the ICFI components by age of development (p<0.001).

Significant differences were found in LAZ scores between low-medium, low-high and between medium-high DDS scores for children aged 6-8 months (p=0.006), 21-24 mo (p=0.017) but not among those aged 9-11 months (p=0.201).

Through the age groups, the post-hoc pairwise comparisons analysis identified statistically significant differences in LAZ scores between low-medium (p<0.001), and low-high FFS (p<0.001). But no difference was noticed between medium-high FFS scores across the 3 age intervals.

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Significant differences were also found in LAZ scores between medium and high meal frequency score (p<0.001), at all ages.
A significant association was found between WAZ and DDS (p=0.006) only for children aged 12-24 months. The Post-hoc pairwise comparisons by Mann-Whitney test showed statistically significant differences in WAZ scores between low-medium (p=0.004) and low-high (p=0.002) DDS scores.
A significant correlation between FFS and WAZ was identified only among children aged 9-11 months (p= 0.019) and those aged 12-24 months (p= 0.011). The Post-hoc pairwise comparisons by Mann–Whitney U test found out statistically significant differences in WAZ scores, between low-medium FFS scores for children aged 9-11 months (p=0.006)and for those aged 12-24 months (p=0.005),along with low-high FFS scores only for those aged 12-24 months (p=0.027).
A significant link between meal frequency score and WAZ only for children aged 9-11 months (p= 0.003) and those aged 12-24 months (p<0.001). The Post-hoc pairwise comparisons showed statistically significant differences in WAZ scores between medium and high meal frequency scores, with regard to children aged 9-11 months (p=0.003) and those aged 12-24 months (p<0.001).
Other variables that had significant impact on nutritional status were: mother's educational attainment after the adjustment for family's socio-economic level.
The Kruskal-Wallis test outlined a significant correspondence between mother's educational attainment, on the one hand, and LAZ (p<0.001), WLZ (p<0.001) and WAZ (p<0.001) on the other hand. Post-hoc pairwise comparisons were conducted and a statistically significant interaction was observed between illiterate-basic levels of mother's education and LAZ<-2 Z-scores (p= 0.048).
The post-hoc pairwise comparisons analysis showed also a statistically significant difference in WAZ>-2 Z-scores between basic-secondary levels of mother's education (p= 0.008).At last, a statistically significant variation was observed in WLZ>-2 Z-scores between basic-secondary levels of mother's education (p<0.001) and between basic-high levels of mother's education (p<0.001).
Multivariate regression analysis was conducted to define if a relationship likely exists between specific maternal and child features and ICFI. The variables included in the equation were gender, age of the mother, mother's educational attainment, socioeconomic status, household monthly income, child's age and birth order. The statistical model was strongly significant (p<0.001). Among these characteristics, mother's education level, family's socio-economic level and household monthly income were all positively and significantly associated (p<0.001) with ICFI score.

DISCUSSION

This study was achieved to parse the efficiency of ICFI in assessing the child-feeding practices and their interdependence with nutritional status of children aged 6–24 months, in accordance with the perspective designed by Ruel and Menon [13] in order to develop a composite index of ICFI based on the recommended positive feeding practices in developing countries.
The actual appraisal of malnutrition's burden in developing countries indicate that despite under-nutrition dominating the nutritional status of under-five children in the MENA region, some countries are experiencing a double burden of malnutrition whereby stunting is coupled with a prevalence of overweight exceeding 10%, such as 15% in Morocco [12].
In other respects, several studies disclosed assumptions relating the Ruel-Menon ICFI and height-for-age or linear growth rate of 6- to 42-mo-old children, internationally. Some reviews [13, 14, 17-20, 31, 32] have reported, for instance, that ICFI is associated with the nutritional status of 6- to 23-month-old children. Whereas other studies have found that, ICFI is not associated with either height-for-age, or height velocity [15].
The global feeding behaviours in our sample were acceptable. At the time of the survey, 76.4 % of the children were still breastfed in conjunction with other foods and liquids needed to meet their evolving nutritional requirements. The median child's age of introducing complementary feeding was 6 months (IQR: 5-6). 93 % of mothers interviewed (n = 276) started dietary diversification between 4 and 6 months, 5.6% (n = 17) diversified beyond six months and 1.4 % (n = 4) began dietary diversification before the age of 4 months.
Despite the European Society of Pediatric Gastroenterology (ESPGHAN) recommend that complementary feeding be initiated between 4 and 6 months of age and preferably should not be delayed beyond 26 weeks [33], the WHO, the United Nations Children's Fund (UNICEF) and American Academy of Pediatrics (AAP)

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exhort the international community to introduce complementary foods up to six months of age [34, 35].
Within the specific context of North Africa, diversification for nearly 85% of infants begins after 4 months [36].
The mean ICFI scores ranged from a low of 7.5±3.4 (Range: 1-12) for both the 6- to 8-mo-old (n=58) and the 12- to 24-mo-old age groups (n=156) to a high of 7.8±3.2 (Range: 1-11) among the 9- to 11-mo-old age group (n=83). The median ICFI score was 9 (IQR: 7-9.5).
The average ICFI, in our study population, was above that observed by Ruel and Menon in Peru 7.05 ± 2.45 (2-11), Nicaragua 6.73 ± 1.99 (1 - 12) and Guatemala 5.93 ± 2 (3-11) [13].It was also beyond that observed by Ntab et al. in Senegal [15], and Sawadogo et al. in Burkina Faso [17]; in this rural study the mean index scores ranged from a low 3.9±2.3 for the 6- to 11-mo-old age group to a high of 6.0±2.0 among the oldest 12- to 23-mo-old age group.
Furthermore, our mean ICFI was also exceeding that observed by N Srivastava& A Sandhu in urban Vadodara in Gujarat (India) 6.48±1.74, by Khatoon T et al in Bangladesh 6.4±1.8, median: 7 [14], Jingxu Zhang et al [31] in china among the 6- to 8-mo-old age group, Moursi et al in urban Madagascar who found a median value of the ICFI of 7 [18], B. Ogunba in Osun State (Nigeria) where the mean ICFI was 1.91 (0–6 months), 2.43 (7–12 months), 2.55 (13–18 months), and 2.51 (19–24 months) [37].
Moreover, our mean ICFI was closer to that reported by Ruel and Menon in Bolivia 7.60 ± 2.53 (2-12) and Colombia 8.16 ± 1.83 [13]. It was nearly similar to that observed by Jing-Qiu Ma, Li- Li Zhou et al in Shanghai 7.19±1.55 (3-10) among the 6-mo-old age group and 7.99±0.83 (5-10) among the 12-mo-old age group [20], and finally by Um-Sap S. Ngo et al in Yaoundé 8.3±2.15 (2-12) [19].
An underlying characteristic of the ICFI is that it is not settled if the previous week's consumption is illustrative of long-term feeding archetypes [15].
A significant relationship was objectified between LAZ and the total ICFI (p<0.001) at all ages. Besides, an interrelation has been embodied between WLZ and ICFI only for children aged 6-8 months (p<0.001),in parallel with WAZ and ICFI regarding the 9- to 11-mo-old age group, along with, the 12- to 24-mo-old age group.
These findings are in line with the scientific literature which recommends length-for-age and weight-for-length instead of weight-for-age for assessing malnutrition and recognizing societies that could take advantage of public health interventions [38].
Pertaining to infants less than 9 months old, there was a significant interrelationship between the ICFI and LAZ scores (p<0.001) and WLZ scores (p<0.001). Nevertheless, no significant interaction was found between WAZ scores and ICFI (p=0.262).The Bonferroni-corrected post-hoc pairwise comparisons performed with a Mann-Whitney U test detected statistically significant variations in WLZ scores between low-high (p=0.008) and low-medium (P<0.001) ICFI categories. No difference was found in WLZ scores between medium and high ICFI categories (p=0.787).
With reference to children aged 9-11 months, there was a relevant association between the ICFI and LAZ scores (p<0.001), along with, WAZ scores (p<0.001). But no significant link was established between WLZ scores and ICFI (p=0.807).The Post-hoc pairwise comparisons analysis pointed out statistically significant differences in WAZ scores between low-medium ICFI categories among the 9- to 11-mo-old age group (P<0.001).
Regarding children aged 12–24 months, statistically significant correlation was ascertained between the ICFI and LAZ scores (p<0.001), as well as WAZ scores (p=0.001). But no significant connection was found between WLZ scores and ICFI (p=0.063).
Correspondingly, other analysis from different parts of the world supported the capacity of ICFI to figure out the child feeding practices and their interconnection with nutritional status of children.
In Latin America, Ruel & Menon assumed that feeding practices were strongly and significantly associated with child HAZ, especially after 12 months of age [13].
With regard to the Asian continent, Jingxu Zhang et al also found that the ICFI is positively correlated with WAZ and WLZ of infants aged 6 to 11 months in rural China [31]. Likewise, in urban Shanghai, Ma J-Q et al showed that ICFI at 6 months was positively associated with child growth status at 18 months indicated that previous feeding practice may predict future growth of children [20].
Otherwise, Srivastava & Sandhu et al. deduced that the index created in India did not impact significantly children nutritional status in presence of confounding effects of maternal characteristics [39]. Nevertheless, Garg et al. reported significant association between ICFI and under-nutrition [40]. In a distinct Indian

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community-based study from West Bengal, Mukhopadhyay et al. reported that standardized ICFI score was significantly lower in undernourished children than those with normal grades and also significantly higher standardized ICFI score in normal than undernourished children [21]. As well, in Bangladesh, Khatoon T et al. found a significant relationship between the ICFI and the LAZs, especially among children aged 12-23 months. Conjointly, their data showed a significant positive correlation between the ICFI and both LAZ and WAZ among children aged 6- 8 months [14].

Concerning the African continent, in Burkina Faso, Sawadogo et al showed that the ICFI was significantly and positively associated with the mean HAZ of children aged 6–11 and 12–23 months, and with the mean WHZ among children aged 12–23 months [17]. Besides, in urban Madagascar, Moursi et al. also found statistically significant link between LAZ and the ICFI among children aged 6-8 months. A longitudinal ICFI (L-ICFI), constructed with use of 3 cross-sectional ICFI (CS-ICFI) constructed for each visit by using data on feeding practices and data from quantitative 24-h recalls, was a good predictor of child growth with an adjusted difference of 0.5 in mean LAZ when moving from the low to the high category of the L-ICFI [18].

Moreover, in Nigeria, Ogunba B. showed that children aged 0-6 and 7-12 months who are stunted, wasted, and underweight have low ICFI [37]. Moreover, in Senegal, Bork et al, assumed that ICFI was strongly and positively related to HAZ at 6–12 mo of age and less strongly associated at 18–24 mo, whereas no indicator was associated with linear growth in this age group [32].Whereas, Ntab et al. found no association between a slightly modified ICFI and HAZ in a sample of 500 rural Senegalese children aged 12–42 months [15].

Association of mean anthropometric indices with the ICFI core components.

The correlation between ICFI essential components with the children's nutritional status was explored separately for all children throughout the age intervals (6-8, 9-11, and 12-24 months).

It should be highlighted that there is no internationally acknowledged recommendation about the food group classification to be used or the threshold referred to as the necessary diversity level to ensure unrelenting child growth [41].

Despite the lack of a standard definition, and the variations to construct diversity and variety scores, our results confirm the existing literature and suggest that both dietary diversity and food group frequency score were correlated with LAZ, particularly during infancy [14, 17, 18, 31, 32, 42].

Many studies have illustrated that some components, such as dietary diversity or food group frequency, have the efficiency of being good indicators of adequate micronutrients intake and are additionally associated with child nutritional status [43-45]. We would point out that it has been confirmed that infant growth is principally accelerated and sensitive to dietary intakes [46].

Furthermore, it is suggested that both dietary diversity and food group frequency score are likely driving the relationship of ICFI with LAZ [20, 32]. It was also supported that frequency of meals or snacks and absence of bottle-feeding are important components, which are significantly associated with the anthropometric indices [17, 18, 31, 37]. Contrastingly, other analysis found that dietary diversity in the last 24 h and frequencies of consumption of animal source foods over the last week were not associated with height growth [15].

A significant link was exhibited between LAZ and all the ICFI components ($p<0.001$), at all ages. Regarding the DDS, significant differences were found in LAZ scores between low-medium, low-high and medium-high DDS scores for children aged 6-8 months ($p=0.006$), 21-24 months ($p=0.017$) but not among those aged 9-11 months ($p=0.201$). Concerning the FFS, as well, the Post-hoc pairwise comparisons identified statistically significant differences in LAZ scores between low-medium ($p<0.001$), and low-high FFS ($p<0.001$). But no difference was noticed between medium-high FFS scores across the 3 age groups.

In addition, significant differences were shown in LAZ scores between medium and high meal frequency score ($p<0.001$), across all the age groups.

Besides , the Post-hoc pairwise analysis showed statistically significant differences in WLZ score, only for children aged 6-8months, between low-medium ($p<0.001$) and low-high scores ($p<0.001$). Furthermore, the Post-hoc pairwise comparisons showed statistically significant differences in WAZ scores between low-medium ($p=0.004$) and low-high ($p=0.002$) DDS scores. Moreover, the Post-hoc pairwise

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comparisons by Mann-Whitney U test found out statistically significant differences in WAZ scores, between low-medium FFS scores for children aged 9-11 months (p=0.006) and for those aged 12-24 months (p=0.005), along with low-high FFS scores only for those aged 12-24 months (p=0.027).

Furthermore, J. Zhang et al. supported that the associations relied basicallyon the components of bottle-feeding, dietary diversity and meal frequency. Dietary diversity, meal frequency and absence of bottle-feeding are important components which are significantly associated with the anthropometric indices [31]. Moursi et al, found that feeding frequency was the only component associated with WLZ [18].

The association between feeding practices and LAZ was also conditioned by other social determinants of health, such as household socio-economic status [13].In previous studies socio-economic factors have emerged as more decisive factors for childhood stunting than biological factors. A gradient relationship exists between household wealth and stunting even within impoverished and hard-to-reach settlements, indicating that among disfavoured populations, socioeconomic unfairness in child health must be fought [47, 48].

We reflected in our study, by pairwise comparisons, statistically significant interaction between illiterate-basic levels of mother's education and LAZ<-2 Z-scores (p= 0.048).

Multivariate regression analysis showed that mother's education attainment and household monthly income were positively associated (p<0.001) with ICFI scores.

Various reviews demonstrated that the effect of maternal education on child health outcomes is explained by socioeconomic status and geographic residence. Consequently, it underscored the need for wide and sustained investments to address social determinants in developing countries such as education, empowerment of girls, and providing decent work alternatives to women [49, 50].A further aspect to underline is that the major challenge in developing countries may be less to heighten global public health spending devoted to basic services, than to guarantee that a definite income rate is spent concretely to improve the quality of maternal and infant health care, such as, enhancing knowledge of child nutrition and adapted eating practices that are vital for child survival and growth [51].

CONCLUSIONS

Our survey has concrete strengths. Mainly, it is a breakthrough in the application of ICFI and its core components for the first time in the Moroccan context. The results from our study corroborate the fact that the ICFI can be utilized as an efficient tool for international comparison of infants and young child feeding practices. Likewise, our review has some constraints. The data is at most from a metropolitan zone, which limits conclusions due to the contextual characteristics of our investigation. For those reasons, further inquiries on the predictive potential of the ICFI on child nutritional status is warranted among healthy children in distinct environment (rural areas and secluded mountain areas) with greater survey sample size in ongoing follow-up stages throughout a longer period of time.

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REFERENCES

1. Eihab F, Muhammad S. Food Policy and Food Security Challenges in the Middle East and North Africa Region. Reference Module in Food Science. 2016.
2. Black R E, Victora C G, Walker S P et al. Maternal and child under-nutrition and overweight in low-income and middle-income countries. The Lancet. 2013; 382 (9890): 427-451.
3. Krishna A. Poverty and health: defeating poverty by going to the roots. Development. 2007; 50(2): 63-69.
4. Bhutta Z A, Das J K, Rizvi A et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost?. The Lancet. 2013; 382 (9890):452-477.
5. Victora C G, Adair L, Fall C, et al. Maternal and child under-nutrition: consequences for adult health and human capital. The lancet. 2008; 371(9609):340-357.
6. Kattula D, Sarkar R, SivarathinaswamyP et al. The first 1000 days of life: prenatal and postnatal risk factors for morbidity and growth in a birth cohort in southern India. BMJ open. 2014; 4(7):e005404.
7. Black R E, Levin C, Walker N et al.Reproductive, maternal, newborn, and child health: Key messages from Disease

ISSN: 2351-8200
JMSR 2017, Vol III; N°3: 297-312

Control Priorities 3rd Edition. The Lancet. 2016.
8. Onyango AW. Dietary diversity, child nutrition and health in contemporary African communities. Comparative Biochemistry and Physiology Part A: Molecular and Integrative Physiology. 2003; 136(1):61-69.
9. World Health Organization. Indicators for assessing infant and young child feeding practices: part 1: definitions: conclusions of a consensus meeting. WHO, Washington DC, USA. 2008.
10. De Onis M, Garza C, VictoraC Get al.The WHO Multicentre Growth Reference Study: planning, study design, and methodology. Food and nutrition bulletin. 2004; 25(1): S15-S26.
11. De Onis M and Blössner M. The World Health Organization global database on child growth and malnutrition: methodology and applications.International journal of epidemiology. 2003; 32(4):518-526.
12. Nasreddine L, Zeidan M N, Naja F, and Hwalla N. Complementary feeding in the MENA region: Practices and challenges.Nutrition, Metabolism and Cardiovascular Diseases. 2012; 22(10):793-798.
13. Ruel M T, and Menon P. Child feeding practices are associated with child nutritional status in Latin America: innovative uses of the demographic and health surveys.The Journal of nutrition. 2002; 132(6):1180-1187.
14. Khatoon T, Mollah M A H, ChoudhuryA M et al. Association between infant-and child-feeding index and nutritional status: results from a cross-sectional study among children attending an urban hospital in Bangladesh.Journal of Health, Population and Nutrition.2011; 349-356.
15. Ntab B, Simondon K B, MiletJ et al.A young child feeding index is not associated with either height-for-age or height velocity in rural Senegalese children. The Journal of nutrition. 2005. 135(3): 457-464.
16. Sakisaka K, Wakai S, KuroiwaC et al. Nutritional status and associated factors in children aged 0–23 months in Granada, Nicaragua. Public Health. 2006; 120 (5):400-411.
17. Sawadogo P S, Martin-Prével Y, SavyM et al.An infant and child feeding index is associated with the nutritional status of 6-to 23-month-old children in rural Burkina Faso.The Journal of nutrition. 2006;136 (3):656-663.
18. Moursi M M, Martin-Prével Y, Eymard-Duvernay S et al.Assessment of child feeding practices using a summary index: stability over time and association with child growth in urban Madagascar. The American journal of clinical nutrition. 2008; 87(5):1472-1479.
19. Um-Sap S N, Awa H M, Hott O et al. Pratique de la diversification alimentaire chez les enfants de 6 à 24 mois à Yaoundé: relation avec leur état nutritionnel. Archives de Pédiatrie. 2014; 21(1):27-33.
20. Ma J Q, Zhou L L, Hu Y Q etal.A summary index of infant and child feeding practices is associated with child growth in urban Shanghai. BMC public health. 2012; 12(1):1.
21. Mukhopadhyay D K, Sinhababu A, Saren A B, and Biswas A B. Association of child feeding practices with nutritional status of under-two slum dwelling children: a community-based study from West Bengal, India. Indian journal of public health. 2013 ; 57(3) :169.
22. Haut-Commissariat au Plan (HCP). Recensement général de la population et de l'habitat, Région Casablanca-Settat. 2014. http://www.hcp.ma/reg-casablanca/attachment/613321/
23. World Health Organization and UNICEF. Global strategy for infant and young child feeding. WHO. 2003.
24. World HealthOrganization. Principes directeurs pour l'alimentation des enfants âgés de 6 à 24 mois qui ne sont pas allaités au sein. WHO. 2006.
25. KottnerJ and Streiner D L. Internal consistency and Cronbach'sα: A comment on Beeckman et al. International journal of nursing studies. 2010; 47(7): 926-928.
26. World Health Organization.Nutrition for Health, WHO child growth standards: growth velocity based on weight, length and head circumference: methods and development. WHO. 2009.
27. De Onis M. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age.WHO.2006.
28. UNICEF.The state of the world's children 2008: Child survival.2007; 8.
29. Haut-Commissariat au Plan (HCP). Les classes moyennes marocaines: Caractéristiques, évolution et facteurs d'élargissement. 2009.http://www.hcp.ma/attachment/294813/.
30. Sprent P and Smeeton N C. Applied nonparametric statistical methods.CRC Press. 2016.
31. Zhang J, Shi L, Wang J, and Wang Y. An infant and child feeding index is associated with child nutritional status in rural China.Early human development. 2009; 85(4): 247-252.
32. Bork K, Cames C, BarigouS et al. A summary index of feeding practices is positively associated with height-for-age, but only marginally with linear growth, in

ISSN: 2351-8200
JMSR 2017, Vol III; N°3: 297-312

rural Senegalese infants and toddlers.The Journal of nutrition. 2012; 142(6):1116-1122.
33. Agostoni C, Decsi T, Fewtrell M et al. Complementary feeding: a commentary by the ESPGHAN Committee on Nutrition.Journal of pediatric gastroenterology and nutrition. 2008; 46(1):99-110.
34. Dewey K. Guiding Principles for complementary feeding of the breastfed child.2003.
35. Gartner L M, Morton J, Lawrence R Aet al. Breastfeeding and the use of human milk. Pediatrics. 2005; 115 (2):496-506.
36. Thimou A, Mdaghri Alaoui A, El Harim El Mdouar L. La diversification alimentaire (DA) d'après une enquête menée au centre de néonatologie du CHU de Rabat. Med Maghreb.2001; 86:21-5.
37. Ogunba B. Infant and Child Feeding Index and Nutritional Status of 0-to 24-Month-Old Children in Osun State, Nigeria.Journal of Nutrition Education and Behavior. 2012; 44(4):S41.
38. Lutter C. Meeting the challenge to improve complementary feeding.SCN news.2003; 27: 4-9.
39. Srivastava N and Sandhu A. Infant and child feeding index. The Indian Journal of Pediatrics. 2006; 73(9):767-770.
40. GargA and Chadha R. Index for measuring the quality of complementary feeding practices in rural India. Journal of Health, Population and Nutrition. 2009; 763- 771.
41. Savy M, Martin-Prével Y, Traissac P, and Delpeuch F. Measuring dietary diversity in rural Burkina Faso: comparison of a 1-day and a 3-day dietary recall. Public Health Nutrition. 2007; 10(01):71-78.
42. Arimond M and Ruel MT. Dietary diversity is associated with child nutritional status: evidence from 11 demographic and health surveys. The Journal of nutrition. 2004; 134(10): 2579-2585.
43. Onyango A W. Dietary diversity, child nutrition and health in contemporary African communities. Comparative Biochemistry and Physiology Part A: Molecular and Integrative Physiology. 2003; 136(1): 61-69.
44. Steyn N P, Nel J H, Nantel G et al. Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy?.Public health nutrition. 2006; 9(05):644-650.
45. Kennedy G L, Pedro M R, Seghieri C et al. Dietary diversity score is a useful indicator of micronutrient intake in non-breast-feeding Filipino children.The Journal of nutrition. 2007; 137(2):472-477.
46. Schroeder D G, Martorell R, Rivera J et al. Age difference in the impact of supplement on growth.JNutr. 1995; 125: 1051S- 9S.
47. Chikhungu L C, Madise N J, Padmadas S S. How important are community characteristics in influencing children′ s nutritional status? Evidence from Malawi population-based household and community surveys. Health and place.2014; 30:187-195.
48. Janevic T, Petrovic O, Bjelic I, and Kubera A. Risk factors for childhood malnutrition in Roma settlements in Serbia.BMC public health. 2010; 10(1):1.
49. Frost M B, Forste R, Haas D W. Maternal education and child nutritional status in Bolivia: finding the links. Social science and medicine. 2005; 60(2):395-407.
50. Di Cesare M, Bhatti Z, SoofiS B et al. Geographical and socioeconomic inequalities in women and children's nutritional status in Pakistan in 2011: an analysis of data from a nationally representative survey.The Lancet Global Health. 2015; 3(4):e229-e239.
51. McGuire J W. Basic health care provision and under-5 mortality: a cross-national study of developing countries. World Development. 2006; 34(3):405-425.