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Prevalence of Anemia, Stunting and Parasitic Infection Among 5-6 Years Children in Gaza Strip, Palestine

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Abstract

Globally, malnutrition is the major problem especially in children, that includes anemia, stunting, wasting, obesity and others. Also, parasitic infections are responsible for morbidity in children worldwide. This study aimed to measure the prevalence of anemia, stunting and parasitic infection among 5-6 years children in Gaza strip. A descriptive cross-sectional study was conducted among 571 preschool children. Data were collected in January and February 2018 based on a multistage sampling which children were selected by a cluster randomization from five kindergartens in five governorates in Gaza Strip. A validated self-administered questionnaire was completed by parents of children to investigate demographic and socio-economic status, dietary habits, lifestyle and physiological factors. Anthropometric measurements such as weight and height were determined as well as blood samples and stool samples were collected. Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) version 22.0. The study contained 52.4% males and 47.6% females which obtained from North Gaza 14.0%, Gaza 42.0%, Middle area 16.3%, Khanyounis 13.1% and Rafah 14.5%. The prevalence of anemia was 40.7%, Stunting 9.1% and parasite infection 17.1%. North Gaza and Rafah were the highest suffering from parasite infection. There a statistically significant association between family size, mother education, income and eating raw fruits with parasite infection. Moreover, there significant association between mother job and anemia and between birthweight and stunting. Regarding dietary habits, all results may be indicated inadequate amount of protein and micronutrient intake for large proportion of children. The prevalence of anemia was high among preschool children which appears to be a public health problem in Gaza Strip. Stunting and parasitic infection seem to be lower than the other studies in previous years. Some interventions to improve children nutritional status must be in concern.

Keywords

Anemia, Stunting, Parasitic Infection, Preschool Children, Gaza Strip

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1. Introduction

Anemia is one of the most serious public health problems affecting people in both developing and developed countries [1]. Children are more vulnerable to developing anemia because they are rapidly growing and liable to infection [2]. However, Anemia poses a major public health issue leading to an increased risk of child mortality [3]. Also, it has negative consequences on cognitive development and physical growth of children from infancy through to adolescence [3], while micronutrients such as iron and folic

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acid are likely to be inadequate in children's diets if parents are not well informed [2].

Globally, one-third of the world's population suffers from anemia, notably over half of the children in developing countries [4]. In preschool-age children, anemia prevalence was 47.4%, affecting 293 million children globally [5]. The highest prevalence was in Africa (67.6%) and South-East Asia (65.5%). In the Eastern Mediterranean, the prevalence was 46% and 20% in the other WHO regions [5].

As well, stunting is an indicator of chronic undernutrition, irreversible beyond the second to the third year of a child's life and is associated with high morbidity and mortality [6]. Stunting is a cumulative process that can begin in the uterus and continue to 2 years after birth. Low birth weight is an important indicator of fetal intrauterine nutrition and strong predictor of subsequent growth and well-being [7].

Moreover, infections by intestinal parasites are a major public health problem worldwide, especially among children in developing countries [8]. By definition, parasites impose costs on their hosts and are partially responsible for shaping the phenotype, genotype, and life-history traits of host organisms [9].

On the other hand, in the Gaza Strip, poverty and food insecurity are increasing, as is a reliance on foreign aid [10]. Unemployment continues to increase amongst youth and adults; it is estimated that at least 58% of the population does not have a regular source of income [10]. At the political level, siege and the external isolation by the Israeli occupation in addition to the Palestinian internal division continue to create barriers to progress, leading to further challenges for Palestinian especially in Gaza Strip, such deteriorated conditions have negatively affected the population particularly children [10, 11]. Therefore, this study aimed to determine the prevalence and the determinants of stunting, anemia and parasitic infection for pre-schools children in the Gaza Strip.

2. Methodology

2.1. Sampling and Sample Size

A descriptive cross-sectional study involving 571 children was used to find out the predictors and the prevalence of malnutrition conditions in Gaza Strip, Palestine. The estimated number of kindergarten children in the Gaza Strip was 66,150 [12]. The total sample size was calculated according to Epi Info program version 2017; 7.2.2., as 333 children, with an expected frequency of 32%, a worst acceptable frequency of 27% and a confidence level of 95%.

Data were collected over 28 days, in January and February 2018 based on a multistage sampling. Five kindergartens were selected by cluster randomization from five governorates in the Gaza Strip. Four to five classes from each kindergarten were selected by simple random method, while systematic selection according to odds numbering for every class has been used (interval equals 2). The study was approved by two entities in Palestine; the Ministry of Health and the Ministry of Education, and informed consents were collected from the children's parents. Recruitment of children depended on objective criteria. The inclusion criteria were: (1) a child aged between 5- 6 years old, (2) stayed in the Gaza Strip more than 1 year before starting data collection. The exclusion criteria were: (1) a child who suffered from any disease that might affect the nutritional status, (2) a child who already enrolled into a treatment regimen for parasite infection, anemia, or growth retardation.

2.2. Self-administrated Questionnaires

Parents of children completed a self-administered questionnaire that divided into two parts. The first part was related to socio-demographic and economic questions, while the second related to the dietary habits, lifestyle and physiological factors. The designed valid questionnaire was pretested and verified for reliability in kindergarten centers that follow the Ministry of Education (MoE), Gaza Strip. The time needed for completing the questionnaire for each case about 30 minutes including the introduction, explaining the objective of the study and writing the informed consent form. The questionnaire collected data regarding parents on social information: age, sex, citizenship, job, residency, family size (small: ≤4 members, medium: 5-7 members, and large: ≥7 members), and level of education of father and mother (Primary: ≤6^{th} grade, Preparatory: 7^{th}-9^{th}, Secondary, 10^{th}-12^{th} grade, and University; bachelor degree and above-involving diploma or 2 years after secondary school). The second part of the questionnaire has involved self-reported information about children health and their dietary habits.

2.3. Anthropometric Measurements

Weight was determined on bare-feet and with light clothes to the nearest 100 g by using Seca scale. Height was measured to the nearest 0.1 cm by using a stadiometer Seca. Height and weight measurements were converted to sex- and age-specific percentiles and z scores using the ANTHRO software program, based on the Centers for Disease Control and Prevention (CDC). The prevalence of stunting was calculated according to the child growth standard of the WHO [13, 14]. The Anthro software was used for calculating the z-score. This study used z-score for stunting =-3 to <-2 SD, and normal = z-score -2 to <+1 SD.

2.4. Biomedical Data

2.4.1. Blood Sample Collection

After obtaining parent permission, blood specimens were collected. Two to three ml of venous blood was drawn from each child into EDTA container for measuring hemoglobin level. The blood sample collected and preserved in the ice bag and transported to the laboratory for examination.

2.4.2. Stool Sample Collection

Stools samples were obtained from the study sample. A clean plastic container was given to the mothers of the study sample to bring it in the morning of the next day. After that added 10% formalin before sending it to the laboratory for examination to keep morphology properties of the parasites.

2.5. Quality Control

The quality control checked the validity and reliability of the main questionnaire and data collection method. The composed questionnaire was carried out on 30 children's mother as a pilot study to enable the researchers to examine the tools of the study in terms of acceptability, applicability and time frame. The data collection process was modified according to the results of the pilot study. All main parts of the questionnaire are valid as they were adopted from previous data and researches [15]. To assess the reliability of the questionnaire, the participants of the study were asked to comment on the appropriateness and clarity of the questionnaire. After the pilot study and collection of participants' feedbacks on the questionnaire, changes were made. The revised questionnaire was verified and reviewed by experts to reconfirm the acceptability and suitability of the instruments used to achieve the objectives. The final form of the revised questionnaire was used in the data collection process.

2.6. Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0 software (SPSS Inc., Chicago, IL, USA). Descriptive statistics included frequencies and percentages for subjects' characteristics and feeding habits. After considering the cut-off points according to standards, descriptive statistics and chi-square (χ^2) are compared to the categorical variables of the subjects' characteristics with parasitic status, stunting, and anemia. Simple bivariate logistic regression was presented by odds ratio (OR) and confidence interval (95% CI) was used to predict the risk factors associated with health/disease concerns. P-value of <0.05 was considered as statistically significant and level of confidence was 95% at a power equal 80%.

3. Results

3.1. Sociodemographic Characteristics

A total of 571 apparently healthy pre-schools children were enrolled in the study to determine the prevalence of stunting, anemia and parasitic infection. Table 1 describes the frequency and percentages of personal characteristics of the subject. Out of 571 children, the major screened subjects were from Gaza governorate 240 (42.0%), while KhanYounis governorate represented by 75 (13.1%) subjects. 299 (52.4%) were male subjects. Regarding family size, 281 (49.2%) were from the medium-sized families, at the time, 44 (7.7%) subjects were drained from small-sized families. Mother education was majorly represented in primary and preparatory levels (≈70.8%), while university-educated mothers approximated 14.0%. Moreover, the vast majority of mothers were housewives 530 (92.8%) compared to 7.2% were working mothers. According to the obtained results, about half of included families 279 (48.9%) had monthly income less than 1000 NIS (3.55 NIS ≈ 1 USD), at the time, 250 (43.8%) families were received some frequent financial assistance.

Table 1. Description of subjects' characteristics.

N = 571		N	%
Region			
	North Gaza	80	14.0
	Gaza	240	42.0
	Middle area	93	16.3
	Khanyounis	75	13.1
	Rafah	83	14.5
Sex			
	Male	299	52.4
	Female	272	47.6
Family size			
	Small Family	44	7.7
	Medium Family	281	49.2
	Big Family	246	43.1
Mother education			
	Primary	242	42.4
	Prep	162	28.4
	Secondary	87	15.2
	University	80	14.0
Mother Job			
	Working	41	7.2
	Housewife	530	92.8
Monthly income			
	less than 1000	279	48.9
	1000-2000	183	32.0
	more than 2000	109	19.1
Received financial assistance			
	yes	321	56.2
	No	250	43.8

3.2. Dietary Habits

Table 2 describes the child-feeding habits; understanding attitude toward healthy foods was the aim of this section. Regarding milk and dairy products, mothers indicated that

251 (44.0%) subjects were fed once daily, while 31 (5.4%) subjects had received one serving per 2 weeks. The same, the majority of subjects were usually fed by eggs once daily or 2-3 servings per week, 203 (35.6%) and 261 (45.7%); consequently. According to meat and meat products, which involved red and poultry meats, 253 (44.3%) subjects were fed 2-3 servings per week and 167 (29.2%) subjects were fed one serving weekly. On the other hand, similar feeding habits has observed between intakes of fishes and internal organs like liver, about a third of subjects fed by one serving per week, and one-third of rest subjects fed by one serving per 2 weeks. In regards to plant sources food, two-thirds of subjects were usually fed by legumes; 2-3 servings per week or at least one serving per week. Furthermore, higher percentages of subjects were fed daily at least by one serving from vegetables and fruits, 71.6% and 53.1%, consequently. Finally, a very high percentage (89.5%) out of the total subjects has received at least one serving daily from sugary and junk food.

Table 2. Description of child-feeding habits.

N=571	Once-daily N (%)	2-3 per week N (%)	once weekly N (%)	Once /2 weeks N (%)	Never eaten N (%)
Milk and dairy products	251 (44.0)	150 (26.3)	75 (13.1)	31 (5.4)	64 (11.2)
Egg	203 (35.6)	261 (45.7)	65 (11.4)	22 (3.9)	20 (3.5)
Meat and meat products	97 (17.0)	253 (44.3)	167 (29.2)	37 (6.5)	17 (3.0)
Liver and internal organs	8 (1.4)	69 (12.1)	194 (34.0)	178 (31.2)	122 (21.4)
Fish	9 (1.6)	69 (12.1)	188 (32.9)	255 (44.7)	50 (8.8)
Bread	532 (94.9)	39 (5.1)	0 (0.0)	0 (0.0)	0 (0.0)
Legumes	80 (14.0)	187 (32.7)	187 (32.7)	91 (15.9)	26 (4.6)
Vegetables	409 (71.6)	103 (18.0)	42 (7.4)	12 (2.1)	5 (0.9)
Fruits	303 (53.1)	139 (24.3)	78 (13.7)	40 (7.0)	11 (1.9)
Sugary and junk foods	511 (89.5)	25 (4.4)	20 (3.5)	13 (2.3)	2 (0.4)

3.3. Prevalence of Anemia, Stunting and Parasitic Infection

Table 3 assesses the prevalence of health and nutrition-related concerns among the screened children (both males and females), which may indicate malnutrition conditions. 36.5% out of 514 subjects were anemic, 9.1% and 10.3% out 571 subjects were stunted and high body mass index-age, respectively. Meanwhile, 17.1% out of 460 subjects were infected by parasites according to lab stool analyses.

Table 3. Assessment of nutrition-related concerns.

Nutrition Status	N	Prevalence	
		n	(%)
Anemia	514	209	40.7
Stunting	571	52	9.1
Parasite Infection	460	98	17.1
High body mass index-age (overweight and obese)	571	59	10.3

The distribution of parasitic infections according to subjects' characteristics is shown in Table 4. Amongst the 460 children (both sexes) who involved in stool analysis to find out parasites, 98 (17.1%) subjects were positively infected by one of the different types of parasites. Selective variables were chosen and represented according to significant distribution, and then, processed by logistic regression to predict which category was the predictor. According to region distribution, in comparison to the middle governorates, north Gaza and south Gaza (Rafah) were predictors of parasitic infection as the following: [OR: 3.285] (95% CI: 1.375 – 7.850, P = 0.007) and [OR: 2.676] (95% CI: 1.101 – 6.506, P = 0.03), respectively. Additionally, the large family size was a predictor of parasitic infection [OR: 4.947] (95% CI: 1.139 – 21.478, P = 0.033). Differently, highly-educated mothers, i.e. university-educated mothers, were predictors to have children parasitic infection compared to lower-educated mother [OR: 2.788] (95% CI: 1.491 – 5.213, P = 0.001). Regarding economic situations, the lowest income families and families without financial assistance were predictors for children parasitic infections as the following: [OR: 2.386] (95% CI: 1.372 – 4.148, P = 0.002) and [OR: 1.676] (95% CI: 1.070 – 2.628, P = 0.024), respectively. Finally, with regards to feeding habits, the consumption of raw fruits by 2-3 servings weekly, one serving weekly, and one serving per 2 weeks were predictors of infection by parasites as the following: [OR: 1.843] (95% CI: 1.047 – 3.244, P = 0.034), [OR: 3.636] (95% CI: 1.949 – 6.784, P = 0.001), and [OR: 3.796] (95% CI: 1.647 – 8.753, P = 0.002), respectively.

Table 4. Distribution of subject characteristics' according to parasitic status.

Variables	Parasitic status		OR	95% CI		p-value
	Infected n (%)	Not-infected n (%)		Lower band	Higher band	
N=460 (100%)	98 (17.1)	362 (63.3)				
Region*						
North Gaza	20 (30.3)	46 (69.7)	3.285	1.375	7.850	0.007
Gaza City	44 (22.2)	154 (77.8)	2.159	0.998	4.670	0.051
Khan-Younis	8 (14.8)	46 (85.2)	1.314	0.472	3.656	0.601
Rafah	17 (26.2)	48 (73.8)	2.676	1.101	6.506	0.030
Middle area(Ref)	9 (11.7)	68 (88.3)				
Family member*						
≤4 member(Ref)	2 (6.7)	28 (93.3)				
5-7 member	43 (18.9)	184 (81.1)	3.272	0.750	14.265	0.115
>7 member	53 (26.1)	150 (73.9)	4.947	1.139	21.478	0.033
Mother education*						
Primary(Ref)	33 (17.0)	161 (83.0)				
Prep	25 (19.5)	103 (80.5)	1.184	0.666	2.106	0.565
Secondary	16 (22.2)	56 (77.8)	1.394	0.713	2.724	0.331
University	24 (36.4)	42 (63.6)	2.788	1.491	5.213	0.001
Monthly income*						
<1000 NIS	63 (27.2)	169 (72.8)	2.386	1.372	4.148	0.002
1000-2000 NIS(Ref)	20 (13.5)	128 (86.5)				
>2000 NIS	15 (18.8)	65 (81.3)	1.477	0.710	3.074	0.297
Financial assistance*						
Yes(Ref)	44 (17.4)	209 (82.6)				
No	54 (26.1)	153 (73.9)	1.676	1.070	2.628	0.024
Raw fruits consumption*						
Once daily(Ref)	33 (13.9)	205 (86.1)				
2-3 weekly	27 (22.9)	91 (77.1)	1.843	1.047	3.244	0.034
Once weekly	24 (36.9)	41 (63.1)	3.636	1.949	6.784	0.001
Once per 2 weeks	11 (37.9)	18 (62.1)	3.796	1.647	8.753	0.002
Never eat	3 (30.0)	7 (70.0)	2.662	0.655	10.813	0.171

Abbreviations; (Ref): The reference category that used for regression analyses; OR: Odds Ratio; 95% CI: 95% confidence interval.
P-value calculated by simple binary logistic regression (significant at p-value ≤ 0.05).
Distribution of categorical variables assumed by Chi-square test.
*Difference is significant at p-value ≤ 0.05 (Measured for Cross-Tabulation Chi-Square Value).

Table 5. Distribution of subject characteristics' according to nutritional statuses.

Part A: Distribution of subject characteristics' according to hemoglobin level

Variables	Hb status		OR	95% CI		p-value
	anemic N (%)	Not-anemic N (%)		Lower band	Higher band	
N= 514 (100%)	209 (40.7)	305 (59.3)				
Mother job*						
Housewife	6 (15.8)	32 (84.2)				
Working	203 (42.6)	273 (57.4)	3.966	1.628	9.664	0.002

Part B: Distribution of subject characteristics' according to stunting status

Variables	Stunting status		OR	95% CI		p-value
	Stunted N (%)	Not stunted N (%)		Lower band	Higher band	
N= 571 (100%)	52 (9.1)	519 (90.7)				
Birth weight*						
Low birth weight (<2.5kg)	7 (23.3)	23 (76.7)				
Normal weight (2.5-4.2kg)	44 (8.6)	466 (91.4)	0.110	0.013	0.0954	0.045
Extra weight (>4.2 kg)	1 (3.2)	30 (96.8)	0.353	0.047	2.651	0.311

Abbreviations; (Ref): The reference category that used for regression analyses; OR: Odds Ratio; 95% CI: 95% confidence interval.
P-value calculated by simple binary logistic regression (significant at p-value ≤ 0.05).
Distribution of categorical variables assumed by Chi square test.
*Difference is significant at p-value ≤ 0.05 (Measured for Cross-Tabulation Chi Square Value).

The distribution of nutritional statuses according to subjects' characteristics is shown in Table 5. It classified according to two conditions, Part A is the distribution of subject characteristics' according to hemoglobin level, and Part B is

the distribution of subject characteristics' according to stunting status. Amongst the 514 children (both sexes) who involved in Hb blood analysis, 209 (40.7%) subjects were anaemic. The only predictor for anaemia was the employment condition of the mother. Working mothers were a risk factor for anaemia compared to not-working mothers [OR: 3.966] (95% CI: 1.628 – 9.664, P = 0.002). On the other hand, amongst the 571 children (both sexes) who involved in stunting assessment, 52 (9.1%) subjects were stunted. The only predictor for stunting status was the birth weight. From the statistics, normal birth weight was protective factors compared to low birth weight [OR: 0.110] (95% CI: 0.013 – 0.0954, P = 0.045).

4. Discussion

4.1. Socio-demographic Characteristics

The present study described some determinants of nutritional status and intestinal parasitic infection of preschool children (PSC) in the five governorates of Gaza Strip (GS). The results showed nearly equal percentage of the males and females (52.4% Vs 47.6%) among children. This characterized the Palestinian community that has an almost equal percentage of males (51%)& females (49%) according to the Palestinian Central Bureau of Statistics [16]. About family size, near half of the surveyed children had a medium family member that usually ranged from 5 to 7 and this finding was also consistent with the characteristics of the Palestinian community in GS [17].

Regarding to education level of mothers, Only 14% of the mothers had a university degree. The highest percentage of the education level of children's mothers was secondary level and less and this reflects the social phenomenon that Palestinian families had a tendency to marry their daughters after the basic level of education. Moreover, unemployment is common among the mothers and this consistent with PCBS [17].

About half of the children families (48.9%) belong to families with monthly income less than 1000NIS, and this indicated a considerable proportion of families in GS did not have adequate monthly incomes which reflected the state of poverty in the Palestinian community and this agree with PCBS [17] which specified in 2017 the percentage of poverty is very high in GS. On the other hand, 56.2% of the families received financial assistant to secure food for their children. Nevertheless, this percentage was very logical because of low family income and increased the cost of the basic goods during the closure of GS.

4.2. Dietary Habits

All results about child feeding habits may indicate the inadequate amount of protein and micronutrient intake for large proportion of children. These might have an adverse effect in the future included malnutrition [18] and immune deficiency as a consequence of malnutrition [19]. Decreases in the amount of protein intake in the GS might be linked to the economic status and higher percentage of poverty especially in the last years, in addition to the expensiveness of the meat. Meat, egg, liver and fish are sources of protein [20] and the majority of children didn't eat sufficient amount from it. According to the healthy food guide pyramid of children [21], each child needs to eat 2-3 servings each day from protein sources to prevent malnutrition. Also, legumes belong to protein [20] but the child need 2-3 servings daily from it [21] and just 14% of children eat legumes daily.

However, 44.0% of children drink milk and eat milk products once daily. Also, this percentage is low because each child needs to 2-3 portions of milk or dairy products daily [21]. It was also found that 71.6% of the surveyed PSC were given vegetables once daily, while 53.1% were given fruits once daily and 28% were given fruits 1-3 each week. These percentages are fairly acceptable. In GS, vegetables are less expensive than fruits where the little percentage of people can buy fruits on a daily basis. According to the food pyramids, the nutritional needs of PSC the children need 3-5 servings of vegetables and fruits at least on a daily basis [21]. Fruits and vegetables provide essential vitamins and minerals that are very important in the biochemical processes [22]. Missing of fruits and vegetables means that PSC did not get enough fiber, vitamins, minerals.

About 95% of the surveyed PSC were given bread and/or cereals at least once a day. These findings were very important and matched with the fact that bread and cereals constitute the backbone of any meal in the GS. About 89.4% of the surveyed children were given sweets, chocolate and candy once daily. Excessive use of sweets leads to tooth decay [23] and increase the opportunity of overweight [24]. According to the food pyramids, the preschoolers need sweets daily but in small amounts.

In this regard, it's important to support the family to choose the different nutrients from all the food groups to ensure the balanced diet in their meals. It seemed also that children suffer from deficiency of some vitamins and minerals that need further investigations.

4.3. Intestinal Parasitic Infection Among Preschool Children in Gaza Strip

The findings of the current study showed that the prevalence of Intestinal parasitic infection (IPI) among preschool children (PSC) was 17.1%. And this result lower than another review study in Gaza strip from 1998 to 2007 which the percent was 24.6% [25]. Contradictory results published

about the effects of IPI on the nutritional anemia among children [26]. In the present study, despite that no statistically significant relationship between IPI and nutritional anemia but the prevalence of IPI was still high among children with anemia as compared with not anemic ones and this agreed with the study done in Gaza strip in 2000 [27]. Also, similar results to Green et al., 2011, where no statistically significant relationship between IPI and nutritional anemia among PSC was found [28] and disagreed with study in Nigeria [29].

However, North Gaza and Rafah have the highest percent of suffering from parasitic infection and this agreement with previous studies conducted in Gaza stripwhich showed that the prevalence of IPI in North Gaza (Jabalia and Beit Lahia) was higher than Gaza city [30, 31]. That can be attributed to most regions in North Gaza and Rafah are rural regions while Gaza and Khan-Younis are an urban area with the more proper sewage system, good hygiene and more urbanization facilities. It was found that the large family size is more affected by a parasitic infection that characterized by low sanitary and hygienic practices, limited food and nutrients. This might explain the transmission of intestinal parasitic infections from person to person and considered as powerful determinants of infection in crowded families. And this consistent with Al-Mohammed et al, 2010 study [32] and disagreed with Gelaw et al, 2013 [33] which showed that the IPI is independent in family size and Al-Zain et al, 2005 [31] which revealed that the decreasing of parasitic infection with increasing family size (members).

The unexpected results were higher maternal educational level have high percent of IPI in their children. This may have no explanation and contradict with previous studies [32, 34, 35] Moreover, low family income without financial assistance is very related to increasing prevalence of IPI and this coincides with Daryani et al., 2012 [36] and Nobre et al., 2013 [37]. Many studies showed that raw vegetables and fruits have contaminated by parasitic infection and are potential sources of transmission of intestinal parasites to the children [38, 39] and this agreed with our study regarding row fruits which most of the children who eat row fruits 2-3 servings weekly, one serving weekly, and one serving per 2 weeks are suffered from IPI.

4.4. Malnutrition Among Preschool Children in Gaza Strip

4.4.1. Anemia

According to the criteria of WHO anemia among PSC in Gaza Strip is a common problem [40]. It is a common nutrition problem among children where the iron need is maximum in this period [41]. The present study estimated the prevalence of anemia to be 40.7% taking the cut–off hemoglobin level of 11g/dl. These findings are similar to other findings carried out locally; for instance, the participatory information collection studies by Palestinian Central Bureau of Statistics (PCBS) at 2010 showed that the prevalence rate of malnutrition among children under five was 41.6% and the rate of increase in the Gaza Strip reached 59.0% and reached their highest level ratios in the northern Gaza, reaching 29.6% compared with the rest of the provinces [42]. Similarly, the PCBS nutrition survey in 2005 indicated that 41.6% of children aged 6-59 months in the Gaza Strip were suffering from anemia [43].

According to the Palestinian Health Information Center (PHIC) and Ministry of Health (MoH) annual reports at 2017 in Palestine, the south and north regions of Gaza strip had the highest prevalence of anemia 83% and 73.7% respectively [44]. Our results are comparable to the results of Selmi & Al Hindi, 2011 who reported significantly different prevalence of anemic children in the different regions of Gaza Strip [45].

By considering the association of socio-demographic characteristics, parents' education, family income and other indicators of residential status, none of these factors was significantly associated with anemia. This study was conducted in Gaza strip community where families are extended and share a similar culture; therefore, the lifestyles of the people, especially dietary habits, are expected to be relatively similar, despite some differences in economic status. So, socio-demographic factors would not have as great an impact on children's nutrition as compared with west bank communities. Our findings were matched with Hussein & Mohamed, 2014 [2], but it opposed Yang et al. who reported the relation of anemia among children with uneducated mothers in china [46].

The present study showed that the prevalence of nutritional anemia among preschoolers of employed mothers were higher compared to the children of unemployed mothers. This might be due to that unemployed mothers seemed to practice proper nutrition and feeding habits as compared to the employed mothers they also follow the proper nutritional criteria for preschool nutrition. Unemployed mothers also have enough time and hours for feeding of their children and to monitor their children health status.

Four possible causes may explain the high prevalence of anemia in the study population; low dietary iron intake, poor bioavailability of dietary iron, calcium intake with iron and blood loss due to intestinal parasites. Low dietary iron intake was not the major cause of anemia because near ninety percent (90.5%) of children consumed meat either daily or weekly or from 2-3 times per week. However, low iron absorption due to inadequate intake of vitamin C or fruits was a probable cause. In addition, dietary intake of a variety

of teas was very common in the study population. Taken together, low vitamin C intake, frequent tea consumption, and the presence of phytates frequently found in vegetables and legumes, reduced iron absorption. Finally, calcium sourced from milk and milk derivatives may be taken with iron source. Calcium (Ca) can inhibit iron (Fe) absorption, regardless of whether it is given as Ca salts or in dairy products. All of this causes agreed with the previous [47, 48].

4.4.2. Stunting

The current study revealed that the overall prevalence of stunting was 9.1% in Gaza strip. In comparison with other studies carried out in children in Gaza Strip. The prevalence of children under five of age with stunted growth rose from 7.5% in 1996 to 9.4% in 2002 [49] to 15.3% in 2006 [50], then decreased to 10.3% in 2008 [51], to 10.1% in 2010 [50], then rose again to 19.6% in 2017 [52]. In the present study, logistic regression analysis showed that low birth weight (LBW) was significantly associated with stunting. About 5% of the study sample was LBW and about more than a quarter of them were stunted. LBW is reported in many studies as a risk factor for malnutrition particularly stunting in children under five years of age [7, 53, 54]. It was essential to ensure that women of childbearing age, especially young mothers, receive optimal nutrition in order to reduce the risk of LBW and break the cycle of stunting [55].

5. Conclusion and Recommendations

To conclude, the prevalence of anemia was high 40.7% among PSC which appears to be a public health problem in Gaza Strip. Stunting and parasitic infection seem to be lower than the other studies in previous years and this is encouraging but need more care to minimize it dramatically. We recommend that a more comprehensive study on a wider scale would be helpful to validate our findings and to stimulate the authorities to address this important childhood health problems. Some interventions to improve children nutritional status must be in concern. Interventions should include short-term emergency measures as well as long term development strategies with an understanding of the limitations, risks, and benefits to each. In addition, food consumption surveys among PSC should be done annually. Moreover, monitoring of Hb levels, as well as other biochemical and clinical examination of PSC, must be carried out on a routine basis for every child. Kindergartens health education sessions for mothers and their children and public education efforts to reduce the prevalence of anemia, stunting and parasitic infection.

Limitations

This study revealed that 9.1% of screened children were stunted according to international scale (height-for-age). Nutrition still one amongst different causes that might lead to developing stunting among growing children. To have more understanding of the determinants of stunting among children, future studies should physically assess the children along with their parent. Evaluation of breastfeeding, micro- and macronutrient deficiencies can help also for understanding malnutrition including the stunting and anemia.

Ethical Consideration

Participation was voluntary. Questionnaire is anonymous, and data were kept confidential. Informed Consent was taken from parent's of the participants before filling the questionnaire.

Conflict of Interest

The authors declare that they do not have any conflict of interest.

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