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Research Article

**A CROSS-SECTIONAL RESEARCH TO ESTABLISH AN
ASSOCIATION BETWEEN EARLY CHILDHOOD
NUTRITIONAL STATUS AND PICKY EATING BEHAVIORS**¹Dr. Narjis Muzaffar, ²Mahwish Zia, ²Neelam Rafiq¹PPHI Skurdu, Field Medical Officer, ²Shalamar Hospital Lahore.**Article Received:** February 2019**Accepted:** March 2019**Published:** April 2019**Abstract:**

Children possess picky eating behaviours which lead to inadequate and unbalanced diet resulting in unfavourable results. However, there is no research work carried out to study nutritional status and picky eating behaviours in detail. We carried out this research to investigate children growth and eating behaviour at Mayo Hospital, Lahore (October 2017 to August 2018). The age of children was in the bracket of 1 – 5 years. We analyzed growth indices and nutrient intake among patients. All those children who were taking small amounts also consumed fewer micronutrients and energy. The picky behaviours which are related to limited variety of results in various density levels of micronutrients. Small amount intake is associated with reduced weight for age in comparison to non-picky eaters; specifically, in the elder children with less intake of diet, refusal of specific food and preference of some food over the other. Those who refused to specific food also posed reduced height for age than non-picky eaters. Outcomes suggest that picky eating behaviour has an association with the intake of a various and unfavourable pattern of the growth in early childhood.

Keywords: *Early Childhood, Growth, Height, Diet and Picky Eating.***Corresponding author:****Dr. Narjis Muzaffar,**
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INTRODUCTION:

Many parents present concerns about the picky eating of their children [1 – 4]. It can contribute to poor intake of diet and status of the growth with long terms effects [2 – 10]. Various research studies report reduced consumption of energy as a result of limited food variety [11]. The patterns of diet intake can bring inappropriate nutrient composition changes of diet and also correlate with unfavorable growth pattern such as for overweight and poor growth [12, 13, 14]. However, past approaches for the evaluation of picky eating behavior are not sufficient to explain these conflicts about the diet intake pattern and its association with growth results. There were different feeding issues as reported in the previous studies which include the insufficient eating amount, preference and refusal to different categories of food or strong preference of specific foods [15 – 18]. Various eating behaviors are associated with picky eating which is dealt with a single question of pickiness, feeding difficulty, feeding practice or perception of the parents [18]. The difference lies in the measurement of such picky eating behaviours with different tools with interpretation issues [19]. Two different studies have tried to define picky eating with children attributes of limited variety eating and small amount eating [20]. Limited variety refers to new food unwillingness, specific food rejection and specific preference of particular food. We examined picky eaters for four picky behaviour aspects and its association with picky behavior among young children [21-24]. This research basically revolved around the questions about eating small mounts, refusal and acceptance for specific food and neophobic behaviour of the children. There was a negative association between height for age and eating small amounts of diet among children. This research aimed to investigate the eating behaviors of the children (1 – 5 years) for their picky eating behaviors in specific consideration to its four constructs. Moreover, we also evaluated the four-construct performance through a qualitative approach and its association with growth and diet intake among children. The hypothesis suggests specific growth and diet pattern of each aspect.

MATERIALS AND METHODS:

Study Participants

We carried out this cross-sectional research to investigate children growth and eating behaviour at Mayo Hospital, Lahore (October 2017 to August 2018). Volunteer children filled the research questionnaire after a detailed explanation of the research protocols. Informed consent was also taken

before the commencement of research with ethical approval of the institutional board.

Measurements

Picky Eating Behaviors

Previous studies also assessed the picky eating behaviors of the children through question-based surveys [19, 23]. The response was distributed in five points scale and healthcare providers were asked to respond to these scales from almost never to almost always. Higher scores refer to higher picky eating behavior, therefore, we transposed the reverse-described questions. A trained dietitian reviewed all the responses. The questions related to four picky eating behaviors included questions like:

How often do you make an attempt to encourage your kid to eat specific food? (small eating routine). The other two questions were described in reverse:

Generally, how much amount of nutrients have been eaten by your child at the end of every meal?

And Does the child possess a better appetite?

There were two reversely described questions for Neophobic behavior:

How often does child try unfamiliar food (new food)?

And

How willing is a child to enjoy offered unfamiliar food (new food)?

Food refusal was reported through the undermentioned question:

How often does a child refuse beans, mushrooms, vegetables, meat, seaweed, shrimp, fish, eggs, shellfish, milk, fruits and yoghurt?

Food preference was reported through:

Does a child eat specific food such as vegetables, beans, seaweeds, mushrooms, fish, meat, shellfish, shrimp and eggs?"

Higher response rate than neutral reflected potential picky eating features. Neophobic behaviour and intake of small amounts were summated rating scales. Therefore, the above three responses were graded as picky eater for both neophobic behaviour and intake of small amounts along with the determination of specific intake and refusal of the food. Item's internal consistency was measured through Cronbach's coefficient for small diet intake (0.80) and neophobic behaviour (0.73). Multiple questions were asked to evaluate all the four constructs on the basis of acceptance and refusal to a specific food on the number of food varieties accepted or rejected by the children. The cut-off value for refusal was (1.8) and for specific food, it was (1.2) which was higher than neutral. All those who refused more than two groups of food were categorized as picky eaters. On the other hand, preferring a specific food preparation method were also picky eaters. In case no group is tried so we

did not count the food groups for refusal or preference. Children having any of the four sub-constructs such as refusal to a specific food, neophobic behaviour, specific food preference and food preparation method were limited variety of children. Picky eaters were those having main constructs of limited variety and small amount eaters.

Dietary Intakes

Every subject was assessed for three days of non-consecutive diet intake with two-dimensional measurement tools. Diet record coding was managed by an expert dietitian supervisor on the basis of a review of the interview and telephonic interviews. Breastfed children were assessed for feeding amount and time [24]. Diet intake data was converted values of nutrient intake through DES-KOREA diet evaluation system which incorporates nutrient database and recipe containing 4222 food items and 3916 recipes [26 – 28]. We also assessed children for mean intake, macronutrients energy distribution, micronutrients nutrient density (intake / 1000 kcal) of energy and total fibre intake.

Growth Indices

Healthcare providers were also asked for the height and weight of the children with BMI. These values were reported and assessed by expert dietitians. WHO recommended conversions were used for conversion of age, height and weight [29]. The weight, length and height scores were converted into Z-Scores for height for age, weight for age and BMI for age in the light of WHO criteria for (0 – 60) months and growth reference for 61 – 228 months [29, 30].

Covariates

We administered a questionnaire to investigate the care environment, feeding practice and eating behaviours of the children. The sociodemographic features included educational level, age and household income of the participants along with sex. We also investigated nutrition plus participation and feeding practice among infants. Infant feeding practice included breastfeeding duration, milk or formula introduction and initiation of supplementary foods. All the information was transferred to binary variables which included initiation of breastfeeding, exclusive breastfeeding in the first three months and six months along with initiation of supplementary foods [31].

Statistical Analysis

Research outcomes have been given in the form of Mean, SD, Number, Percentage along with categorical variables. The differences in Z-Scores and Nutrient intake of growth indices between both non-picky and picky eaters for every construct was also analyzed to adjust sex, age, educational level and various variants [32]. We used SAS for statistical analysis (P-Value 0.05).

RESULTS:

Detailed outcomes analysis about Age, Weight, Height, BMI, Children Characteristics, Infant Practice of Feeding, Nutrition Plus b participation, Picky Eating Practice, Father's Education, Household Income, Nutrient's intake, refusal to specific food, acceptance of specific food and comparison of growth has been shown in given tabular and graphical data.

Table – I: Mean and SD Values of Various Variables

Variables	Mean	±SD
Age (Years)	2.8	1.40
Weight	0.1	0.80
Height	-0.3	1.10
BMI	0.3	1.00

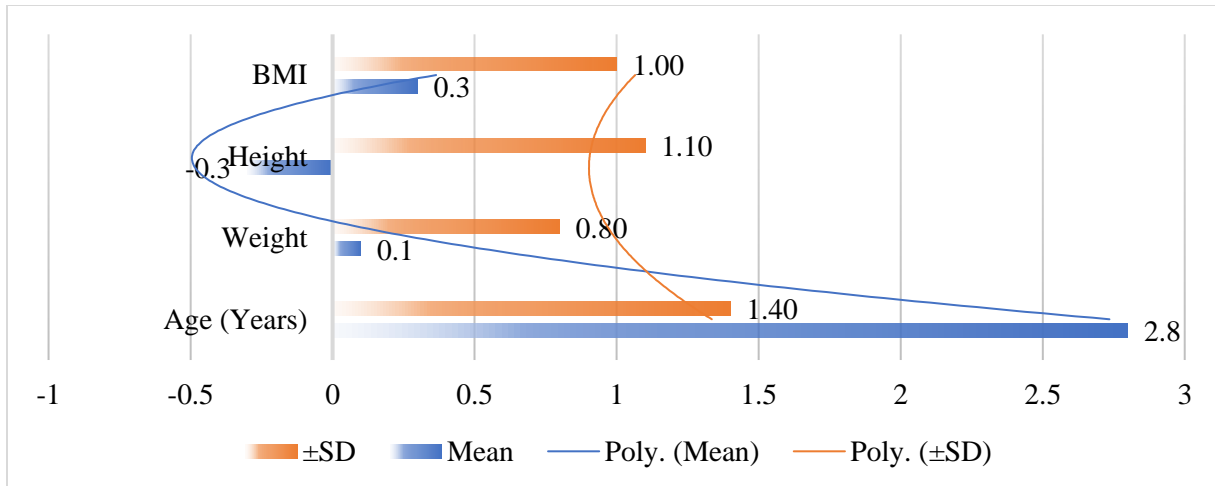


Table – II: Selected characteristics of children aged 1 to 5 years and their caregivers (184)

Variables		Number	Percentage
Children Characteristics	Boys	90	48.9
	Girls	94	51.1
Infant Practice of Feeding	Infant feeding practice Breastfeeding initiation	177	96.2
	Exclusive breastfeeding under 3 months of life	166	90.2
	Exclusive breastfeeding under 6 months of life	93	50.5
	Introduction of complementary foods ^a before 6 months	55	29.9
Nutrition Plus ^b participation	Yes	72	39.1
	No	112	60.9
Picky Eating Practice	Picky eating behaviour ^c	129	70.1
	Eating a small amount	55	29.9
	Limited variety ^d	123	66.9
	Neophobic behaviour	60	32.6
	Refusal of specific food groups	81	44
	Preference for a specific food preparation method	91	49.5
Father's Education	The education level of father \leq High school	18	9.8
	University	137	74.5
	Graduate school	29	15.8
	The education level of mother \leq High school	29	15.8
	University	135	73.4
	Graduate school	20	10.9
Household Income	\leq \$ 2800	76	41.3
	\$ 2800 to \$ 3900	58	31.5
	\geq \$ 3900	50	27.2

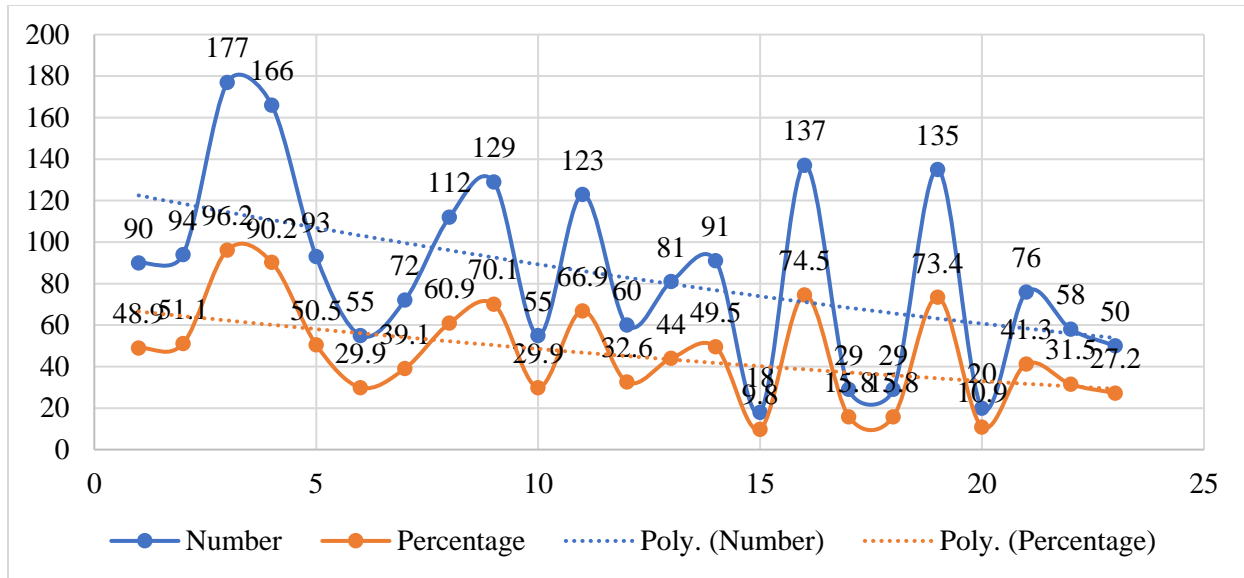


Table – III: Refusal to Specific Food

Food Groups	Refusal to Specific Food (Percentage)
Beans	32.00
Vegetables	22.00
Mushrooms	21.00
Seaweeds	17.00
Meat	8.00
Fish	4.00
Shrimp	18.00
Shellfish	37.00
Eggs	4.50
Fruits	3.50
Milk	7.50
Yoghurt	5.50

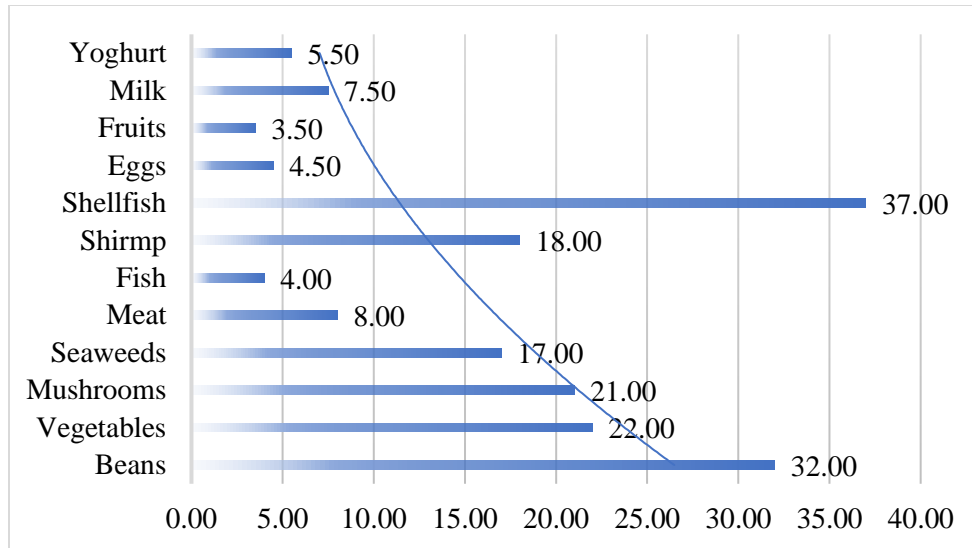


Table – IV: Preference for Specific Food

Food Groups	Preference for Specific Food (Percentage)
Beans	22.50
Vegetables	19.50
Mushrooms	13.50
Seaweeds	9.50
Meat	9.50
Fish	23.00
Shrimp	15.00
Shellfish	25.10
Eggs	4.00

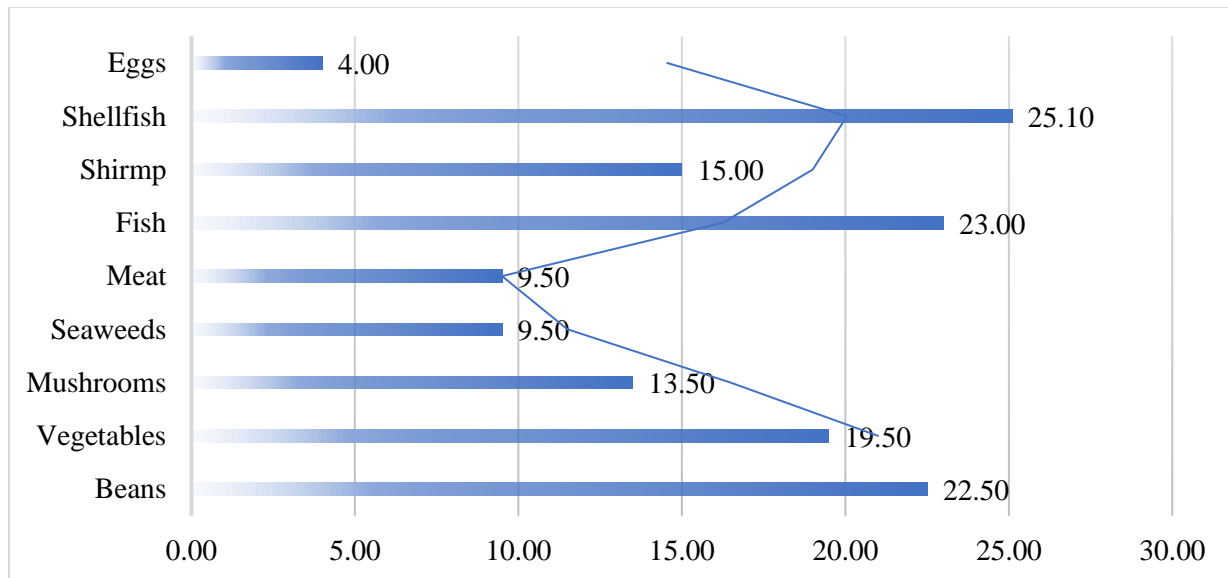


Table – V: Comparison of nutrient intakes

Variables		Eating Small Amounts			Neophobic Behavior			Refusal of Specific Food Groups			Preference for Specific Food Preparation Method		
		Yes (55)	No (129)	p^a	Yes (60)	No (124)	p^a	≥ 2 (81)	0-1 (103)	p^a	≥ 1 (91)	0 (93)	p^a
Mean daily dietary intake	Energy (kcal)	115 ± 340	134 ± 348	5E-04	129 ± 393	127 ± 336	0.69 ± 6	126 ± 364	130 ± 348	0.22 ± 1	126 ± 361	130 ± 350	0.12 ± 7
	Protein (% Energy)	16 ± 3	16 ± 2	0.88 ± 8	16 ± 2	16 ± 2	0.07 ± 5	16 ± 2	16 ± 2	0.8 ± 2	16 ± 2	16 ± 2	0.45 ± 5
	Lipid (% Energy)	24 ± 5	24 ± 5	0.47 ± 9	24 ± 6	24 ± 5	0.43 ± 9	24 ± 5	24 ± 5	0.65 ± 8	23 ± 5	24 ± 5	0.81 ± 7
	Carbohydrate (% Energy)	60 ± 6	61 ± 6	0.59 ± 6	60 ± 6	61 ± 6	0.18 ± 8	60 ± 6	61 ± 6	0.78 ± 3	61 ± 6	60 ± 5	0.93 ± 7
	Calcium (mg)	416 ± 146	449 ± 217	0.22 ± 5	440 ± 209	438 ± 194	0.35 ± 5	404 ± 157	466 ± 223	0.09 ± 2	411 ± 162	466 ± 227	0.07 ± 1
	Iron (mg)	8 ± 3	10 ± 4	0.00 ± 7	9 ± 3	10 ± 4	0.09 ± 4	9 ± 3	10 ± 5	0.02 ± 3	9 ± 3	10 ± 5	0.01 ± 5
	Vit. A (µg RE)	393 ± 205	460 ± 239	0.03 ± 7	382 ± 187	468 ± 245	0.08 ± 6	386 ± 187	483 ± 252	0.00 ± 6	404 ± 199	475 ± 254	0.02 ± 3
	Thiamin (mg)	0.66 ± 0.24	0.78 ± 0.26	0.01 ± 2	0.78 ± 0.29	0.72 ± 0.25	0.56 ± 8	0.71 ± 0.27	0.76 ± 0.25	0.03 ± 7	0.74 ± 0.26	0.75 ± 0.26	0.15 ± 6
	Riboflavin (mg)	0.9 ± 0.3	1.0 ± 0.3	0.00 ± 7	1.0 ± 0.3	1.0 ± 0.3	0.65 ± 6	0.9 ± 0.3	1.0 ± 0.3	0.04 ± 4	0.9 ± 0.3	1.0 ± 0.3	0.18 ± 7
	Niacin (mg)	8 ± 3	9 ± 3	0.00 ± 2	9 ± 4	9 ± 3	0.21 ± 8	9 ± 3	9 ± 3	0.16 ± 4	9 ± 3	9 ± 3	0.17 ± 5

	Vit. C (mg)	77 ± 55	94 ± 61	0.03 8	83 ± 64	92 ± 57	0.11 2	82 ± 57	95 ± 61	0.02 7	89 ± 67	90 ± 52	0.45 1
	Total Dietary Fiber (g)	11 ± 4	13 ± 5	0.01 2	12 ± 5	12 ± 4	0.10 3	12 ± 5	13 ± 5	0.01 1	12 ± 5	13 ± 5	0.09 8
Nutrient density (intake/1000 kcal)	Calcium (mg)	371 ± 113	332 ± 111	0.20 4	336 ± 102	347 ± 117	0.25 6	327 ± 103	357 ± 118	0.31 7	328 ± 93	359 ± 127	0.19 4
	Iron (mg)	7 ± 2	7 ± 3	0.27 1	7 ± 1	7 ± 3	0.11 6	7 ± 1	8 ± 3	0.05 2	7 ± 2	8 ± 3	0.07
	Vit. A (µg RE)	349 ± 172	348 ± 172	0.46 7	301 ± 151	371 ± 177	0.15 5	315 ± 154	375 ± 181	0.05 1	325 ± 146	371 ± 192	0.12 5
	Thiamin (mg)	0.56 ± 0.12	0.58 ± 0.12	0.37 2	0.60 ± 0.13	0.56 ± 0.11	0.18 1	0.56 ± 0.13	0.58 ± 0.11	0.03 4	0.58 ± 0.11	0.57 ± 0.12	0.65 7
	Riboflavin (mg)	0.8 ± 0.2	0.8 ± 0.2	0.63 8	0.8 ± 0.1	0.8 ± 0.2	0.26 9	0.7 ± 0.1	0.8 ± 0.2	0.17	0.7 ± 0.1	0.8 ± 0.2	0.63 5
	Niacin (mg)	7 ± 1	7 ± 2	0.07 6	7 ± 1	7 ± 1	0.06 8	7 ± 1	7 ± 1	0.30 6	7 ± 1	7 ± 2	0.72 1
	Vit. C (mg)	68 ± 35	71 ± 42	0.25 8	64 ± 42	72 ± 39	0.16 2	65 ± 38	73 ± 42	0.07 7	69 ± 42	70 ± 38	0.65 6
	Total Dietary Fiber (g)	9 ± 3	10 ± 2	0.47 8	9 ± 2	10 ± 3	0.01 7	9 ± 2	10 ± 3	0.00 7	10 ± 2	10 ± 3	0.36 6

Proportion of Picky Eaters

In terms of proportion, we reported 29.9% small amount eaters, 66.9% of limited variety, 49.5% of specific food-preparation method preference, 44% refusal to specific food and 32.6% of neophobic behaviour. Higher eating behaviour was found among the elder age group than young children related to food variety (47.5%) and neophobic behaviour (25.6%) (P-Value = 0.0032). Majority of the children were found with multiple picky behaviours with different proportions for each construct such as refusal to take specific food (67.3%), neophobic behaviour (43.6%), eating small amounts (40%) and refusal to the specific food (75%). Tabular data also shows detail about refusal and acceptance of various food items such as shellfish, vegetables, beans etc. Children also demanded specifically prepared food such as beans and shellfish. Three percent required eggs. Specifically, prepared fish was accepted by most of the children.

Comparison of the Dietary Intake and Growth Indices between Picky Eaters and Non-Picky Eaters

Dietary Intake

Diet intake features of picky eaters than non-picky eaters were different in various aspects as shown in the tabular data. Lower intake of energy was reported

among those children who took small amounts of food for micronutrients except calcium. For limited variety, picky eating behaviour the energy intake variation was not significant among both non-picky and picky eaters. Neophobic behaviour children consumed a small amount of fibre. Picky eaters who refused to specific food items consumed reduced amounts of micronutrients, with an exception of niacin and calcium intake. Significant variation was found in micronutrients and nutrient density for some of the micronutrients. Vitamin-A and iron intake were associated with a specific food preparation method.

Growth Indices

Table – IV presents growth indices comparison of both non-picky and picky eaters. Lower weight for age Z-Scores was presented in the small amount picky eaters (P-Value = 0.0010), Height for age (P-Value 0.054) and BMI for age (P-Value = 0.0278). Significant Lower Z-Scores of all indices were reported in the four to five years old small amount picky eaters. Picky eaters who refused to take specific food presented reduced height for age as well.

DISCUSSION:

It is difficult to assess picky eating behaviour due to multiple definitions and different measurement tools. Various definitions make it a complex behaviour with

various unidentified features. Therefore, we dealt with various picky eating behaviours differently with differing nutritional status. Outcomes suggested that picky eating behaviour consists of various other constructs with respectively associated outcomes. We also adopted known approaches of limited variety and intake of small amounts of food along with three sub-constructs including the preference of specific cooking method, refusal to specific food and neophobic behaviour [19, 23]. Intake of small amounts means limited variety and inadequate food which includes neophobic behaviour referring to food avoidance. It is likeness for some kind of food and dis-likeness for another type of food [19, 23]. Less energy was consumed by those children who took small food amounts along with low growth pattern. Picky eaters presented few behaviours like spitting out of the food or throwing food away; such behaviours lead to intake of a small amount of the diet by such children [33]. Additionally, care providers also experienced difficulties in feeding such children which presented low appetite [34]. Such attitudes were taken as fussy behaviours and they were issues of diet intake among children. Past studies also show lower intake of fibre, folate and Vitamin E among picky eaters; these children also gained less weight with reduced growth indices [2, 4, 5, 6, 12, 17]. Past research studies did not try to investigate and identify picky eating patterns with growth outcomes and nutrient intake.

Another author reported that picky eaters posed reduced BMI for their respective age [12]. Reduced BMI to age risk increases with increasing age especially among picky eater children [30]. We reported a prominent association between picky eating behaviour and growth indices especially among young age groups. Older age groups with picky eating habits also posed reduced height and BMI with long-term unfavourable outcomes.

Other studies also report rejection of food and food neophobia especially for fruits and vegetables [35, 36]. We reported picky eaters associated with limited food variety presented lower diet quality for some of the micronutrients but not for the energy. However, who refused food presented reduced height for age among four to five years old children. Lower Height for age Z-Scores was present among young picky eaters who had "neophobic behaviour" (P-Value = 0.0657) and BMI for age with higher Z-Scores (P-Value = 0.0575). In case we do not treat and counter food neophobia; it may lead to permanent refusal of certain food items while initiation of complementary food. Therefore, among young children, the concerns are about long-

term growth impacts and food neophobia even in an uncompromised energy composition.

Likeness and dis-likeness of the colour also matter in the food rejection process [37, 38]. Food changes colour, texture and taste while cooking. Majority of children who rejected some food items also preferred other food items without any compromise on the growth indices. Interestingly, the change in food choice towards fish was amazing. Disliked food, if prepared differently and appropriately; it may shift from disliked to liked. These outcomes also imply that positive food intake will be helpful for better growth indices. Further research work is required to make a deep analysis of the acceptance and rejection of various food items.

We did not completely evaluate potential confounders of both child characteristics and socio-demographic features. The preparation of food with changes in colour, taste and texture was a newer approach employed in this research. We did not consider childcare influence and parents' estimation of the children dietary intake. The sample population was also marginal. Even in the presence of different limitations, the research adds to the overall comprehension of the topic. There are various aspects of picky eating behaviour of the children. More research work will enhance a better understanding of the concept.

CONCLUSIONS:

The outcomes of this research establish measurements and concepts about the picky eating behaviours as it investigated the correlation of picky eating with growth and diet in the early stage of childhood among children. The specific measurement included small amount intakes, neophobic behaviour, specific food refusal and specific food preparation method preference. This research explains in detail different picky eating problems issues at an early stage of childhood. Outcomes suggest about the picky eating behaviours that small amount intakes have an association with inadequate nutrient intake and it also creates an undesirable pattern of children growth. However, we still need to investigate long-term diet intake impacts on the health of a child.

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