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Inadequate Dietary Intake in Women with Antenatal Psychological Distress: A Population Based Study in Pakistan

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Abstract This study examined the relationship of psychological distress with dietary intake of food groups, energy, macronutrients and micronutrients among pregnant women from Peshawar, Pakistan. A total of 230 pregnant women who attended antenatal care between September 2011 and December 2012, were enrolled. Psychological symptoms were assessed using Depression, Anxiety and Stress scales (DASS-42). Respondents were dichotomized into psychologically distressed (with DAS symptoms) and non-distressed groups (without DAS symptoms) based on the cut-off values for each set of symptoms of depression, anxiety and stress. Data on dietary intake, emotional support and demographic-socioeconomic characteristics were collected using pre-tested questionnaires. A total of 45% (n=104) of the respondents reported mild to severe symptoms of psychological distress. Overall, compared to women without DAS symptoms, distressed women had a tendency to consume less variety of foods, and had lower intakes of some key food groups (milk, meat and fruit). Mean dietary intake of fibre was higher in the distressed group than those without DAS symptoms (adjusted $p<0.001$); this was probably due to the higher intake of vegetables in this group. Mean dietary intake of calcium, iron, vitamin B3 and food variety score (FVS) were lower in distressed women ($p<0.05$) even after adjustment. The presence of antenatal DAS symptoms was significantly associated with low dietary diversity (below the median of FVS) (Adjusted OR = 1.98; 95% CI 1.12; 3.47). Family income and partner's emotional support during pregnancy were also associated with low dietary diversity. There is evidence that, in comparison to women without DAS symptoms, distressed women had lower dietary intakes of animal foods and some essential micronutrients with less dietary diversity. There is a need to develop policies focusing on maternal antenatal psychological health across the globe, particularly in developing countries where the burden of maternal and infant morbidity and mortality is ever increasing.

Keywords: *dietary diversity, psychological distress, pregnancy, Pakistan*

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1. Introduction

Pregnancy is the stage of life through which women experiences physiological changes. These changes are important both for maternal antenatal health and fetal development. In pregnancy there are often high levels of psychological problems that can lead to changes in health and nutritional behaviours such as dietary intake, food choices and preferences [1]. Psychological distress is a nonspecific term that encompasses a number of negative emotional and mood states like anxiety, stress, sadness, depression and frustration [2]. Poor nutritional behaviours associated with reduced dietary intake have been found in people with psychological distress, both in pregnant [3,4] and non-pregnant women [5]. In pregnancy, this may lead to adverse health outcomes for both mother and fetus [6]. Healthy dietary patterns are not only essential during pregnancy; they also influence women's health in the postpartum stage as they have been associated with reduced risk for postpartum depression [4].

Pakistan, currently the 6th most populous country in the world, will become the fourth largest nation in population terms by 2050 [7]. Various studies have been conducted in Pakistan focusing on the prevalence of psychological disorders and identifying potential risk factors for them in the adult population. A systematic review of 20 studies revealed the prevalence of various psychological disorders

in a range of 29% to 66% in women from different cities of Pakistan [8]. Few studies, however, have assessed the prevalence of psychological disorders and their determinants in pregnant women [9,10].

To the best of our knowledge, no previous study in Pakistan has investigated the association between antenatal psychological status and maternal dietary energy and nutrient intakes. This is the aim of the present study.

2. Materials and Methods

2.1. Subjects and Sample Selection

The study was conducted between September 2011 and December 2012. The sample consisted of women receiving antenatal care in the Obstetrics and Gynecology unit of the *Mian Rashid Hussain Shaheed* Memorial hospital, located in *Pabbi*, a semi-urban area in Peshawar region. Ethical approval to conduct the study was obtained from the University Research Ethics Committee and medical executives of the hospital. Inclusion criteria for enrolment of women were all those aged >18 years, currently in the last trimester (gestational age > 27 weeks) but previously registered in the hospital in the first trimester and free from any chronic diseases. Consent was obtained from each study participants before data collection.

2.2. Assessment of Antenatal Psychological Health

Women's antenatal psychological health status was measured using Urdu (national language that is widely understood in Pakistan) translated version of the Depression Anxiety Stress Scale (DASS-42) [11]. The DASS has been shown to be a valid and reliable measure of the dimensions of depression, anxiety and stress separately but also covers more general dimensions of psychological distress. The DASS-42 contains 42 relevant statements (14 statements each for depression, anxiety and stress sub-scales) to recognize the presence and severity of symptoms of the three psychological traits. The Depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest or involvement, anhedonia, and inertia. The Anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The Stress scale is sensitive to levels of chronic non-specific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive and impatient [12]. Early findings reported that DASS-42 had excellent internal consistency and test-retest reliability and can distinguish between features of depression, physical arousal, and psychological tension and agitation better than other existing measures [13]. The DASS has been widely used in studies on perinatal psychological health [14,15,16]. DASS-42 has been found to be a reliable and authentic tool to identify the three states of psychological distress i.e. depression, anxiety and stress (DAS) separately. Each statement in the DASS-42 is rated on a 4-point scale (0 for *always false or not applicable* to 3 for *always true or totally applicable*). Higher scores indicate greater levels of distress. Women in the current study were dichotomized based on the cut-off values for depression, anxiety and stress. Internal consistency and reliability of the DASS-42 for each sub-scale and the overall scale were determined using Cronbach's alpha [17]. Cronbach's alpha coefficients were 0.85, 0.82, 0.87 and 0.89 for DASS depression, anxiety, stress and total scales respectively. These coefficients demonstrated good internal consistencies. Women with symptoms of DAS were those who had scores for depression, anxiety and stress higher than the cut-off values for all the three negative psychological traits. These women had mild to severe DAS symptoms (n=104). The rest of the sample were women with scores below the cut-off for all three traits (n=126). In this way, total of 230 pregnant women were included in the study**.** Women who showed symptoms above the cut-off for only one or two of the psychological traits and not for the third one were excluded from analysis (n=30). Women were labelled as 'with and without DAS symptoms' for examining statistical differences in various dietary characteristics.

2.3. Dietary Assessment

Dietary status of the respondents was assessed through personal interviews. Dietary data was collected by trained graduates of human nutrition in a clinic setting or at the women's house. Household portion sizes were obtained using standardized measures (plates, cups, glasses, bowls, and spoons). Assessment of maternal dietary intake was carried out using a validated semi-quantitative food frequency questionnaire (FFQ). The FFQ comprised 91 locally available food items; it had also open ended questions to ask respondents to add the frequency and amount of any other food consumed that was not listed. Dietary data were used to determine average amounts and frequency of consumption of food categories. Similarly dietary energy, carbohydrate, protein, fat, fiber, minerals (calcium, iron, zinc, phosphorus) and vitamin (A, B1, B2, B3, C) intakes were determined by using Pakistani Food Composition Table [18]. Data from the FFQ was also used to generate a food variety score (FVS), which reflects the number of different food items consumed over a week. FVS is a simple measure of dietary quality and household access to a diversity of food [19]. For this purpose, some food items of similar nutritional quality were grouped as a single food type. Food items selected for FVS included cereals (wheat nan, chapatti, parotha (fried pan-cake), bread, corn-bread), meat (beef, mutton, chicken, fish, minced meat), egg, milk (fresh milk, yogurt or buttermilk), fresh fruits, fat or oil, green vegetables and legumes/beans. Scores were assigned based on frequency of selected food items per week; daily intake: 7, 6 down to 1 times per week and < 1 time per week: 0. The FVS was calculated by summing the frequency scores of the eight selected food items (maximum FVS score: 56). FVS was dichotomised at the median value to generate 'high and low' dietary diversity (DD) groups. Data on other relevant parameters like demographic socioeconomic status and emotional support were collected using pre-tested questionnaires.

2.4. Statistical Analysis

All data were analysed using the Statistical Package for the Social Sciences, SPSS Version 18 (SPSS Inc. Chicago,

IL, USA). Descriptive analysis was first performed to clean the data from errors. Appropriate statistical tests were performed at the significant level of 0.05 for continuous and categorical variables. A variable indicating cumulative DAS score was generated by adding the scores of the individual sub-scales for each participant. Student's t-test and Chi-square tests were used to compare socio-demographic and dietary characteristics among DAS groups. Analysis of covariance was used to adjust for important covariates including maternal age, parity, husband emotional support, and monthly income of the family. Similarly, association between dietary diversity and maternal antenatal psychological health, socio-economic and emotional support was also assessed. Univariate logistic regression analyses were first carried out to identify possible predictors associated with dietary diversity in women. Multiple logistic regression analyses were then used to compute adjusted odds ratios for all variables that were significantly associated with dietary diversity.

3. Results and Discussion

3.1. Results

3.1.1. General Characteristics

Table 1 shows general demographic socioeconomic characteristics by DAS groups. Distressed women were more likely to be younger and have lower monthly income than the rest ($p<0.05$). Similarly, comparing to women without DAS symptoms, distressed women were more likely to be primiparas (31% vs 47%, p=0.018), living in rented accommodation (17% vs 31%, p=0.011) and in joint families (60% vs 76%, p=0.017) and less likely to have a partner engaged in a self-employed occupation, e.g. running own business (35% vs 14%, p=0.002). These results suggest that on average, women without DAS symptoms had relatively better socioeconomic background than distressed women.

Table 1. General demographic-socioeconomic characteristics of the study sample

	Depression/Anxiety/Stress symptoms		
Characteristics	**No (n=126)**	**Yes (n=104)**	***p-values***
	Mean (95% CI)		
Maternal age (year)	24.44 (23.74; 25.15)	23.30 (22.47; 24.14)	0.038
Husband age (year)	31.74 (30.66; 31.81	30.21 (28.98; 31.44)	0.101
Monthly income *in thousands* (Rs.)*	27.41 (25.83; 28.99)	24.91 (23.08; 26.75)	0.041
Family size	6.56 (6.15; 6.98)	7.22 (6.61; 7.84)	0.073
	No. of women (%)		
Parity			
Primiparas	39 (31%)	49 (47%)	0.018
Multiparas	87 (69%)	55 (53%)	
Home status			
Own	105 (83%)	72 (69%)	0.011
Rented	21 (17%)	32 (31%)	
Family type			
Joint	76 (60%)	79 (76%)	0.017
Nuclear	50 (40%)	25 (24%)	
Husband Education			
No formal education	95 (75%)	85 (82%)	0.660
Primary education	15 (12%)	8 (8%)	
High School education	11 (9%)	7 (7%)	
College/university education	5 (4%)	4 (3%)	
Husband occupation			
Labour, local (daily wagers)	52 (41%)	51 (49%)	0.002
Labour, abroad	16 (13%)	21 (20%)	
Self-employed	44 (35%)	14 (14%)	
Government services	14 (11%)	18 (17%)	

*Rs=Rupees

3.1.2. Food group intakes

Table 2 shows that compared to women without DAS symptoms, distressed women had milk, meat and fruit less often and vegetables more often. There were no differences between the two groups in frequency of consuming cereals, fat/oil or pulses. These food group differences are reflected in the nutrient differences shown in Table 3.

3.1.3. Nutrients Intakes and Food Variety Score (FVS)

Dietary energy, nutrient intakes and FVS by DAS group are displayed in Table 3 (unadjusted and adjusted models). In both the unadjusted and adjusted analysis, no significant differences in mean intakes of dietary energy, carbohydrate, fat or protein between the groups were found ($p>0.05$). However, a difference in dietary fibre intakes between the groups was evident which was strengthen by adjustment showing a higher average intake in women with DAS symptoms than in the rest ($p<0.001$). The only differences in the unadjusted intakes of minerals and vitamins between the groups were for calcium, iron and vitamin B3. Again these were strengthen by adjustment and were, on average, higher in women without DAS symptoms than in distressed women ($p<0.001$). In both unadjusted and adjusted analysis FVS of the distressed group was, on average, lower than that of the others ($p<0.001$).

Table 2. Weekly frequency of food intake by groups

		Depression/Anxiety/Stress symptoms		
Food groups*	Frequency categories	No (n=126)	Yes (n=104)	p-value
		No. of women (%)		
Cereals	Never/rarely	0 (0%)	0 (0%)	p=0.853
	1-3 days	0 (0%)	0 (0%)	
	4-6 days	4 (3%)	2 (2%)	
	Daily	122 (97%)	102 (98%)	
Milk	Never/rarely	3 (2.4%)	5 (5%)	p=0.003
	1-3 days	51 (40.5%)	62 (60%)	
	4-6 days	33 (26.1%)	24 (23%)	
	Daily	39 (31%)	13 (12%)	
Meat	Never/rarely	16 (13%)	20 (19%)	p=0.000
	1-3 days	42 (33%)	56 (54%)	
	4-6 days	50 (40%)	17 (16%)	
	Daily	18 (14%)	11 (11%)	
Fat/oil	Never/rarely	0 (0%)	0 (0%)	p=0.330
	1-3 days	9 (7%)	5 (5%)	
	4-6 days	15 (12%)	7 (7%)	
	Daily	102 (81%)	92 (88%)	
Pulses	Never/rarely	33 (26%)	20 (19%)	p=0.361
	1-3 days	66 (52%)	52 (50%)	
	4-6 days	20 (16%)	24 (23%)	
	Daily	7 (6%)	8 (8%)	
Vegetables	Never/rarely	2 (2%)	2 (2%)	p=0.001
	1-3 days	75 (59%)	37 (36%)	
	4-6 days	20 (16%)	36 (35%)	
	Daily	29 (23%)	29 (28%)	
Fruits	Never/rarely	13 (10%)	12 (11%)	p=0.004
	1-3 days	33 (26%)	50 (48%)	
	4-6 days	51 (40%)	28 (27%)	
	Daily	29 (23%)	14 (13%)	

*__Cereals__ include wheat nan, chapatti, parotha, bread, corn-bread; **Milk** includes fresh cow milk, yogurt, buttermilk; **Meat** includes beef, mutton, chicken, chicken egg, fish, minced meat., **Pulses** include all legumes, beans and nuts; **Vegetables** include green vegetables; **Fruits** include all fresh fruits; **Fats/ oil** include added fats/oil to the food items

Table 3. Dietary intake of energy and nutrients by groups

		Depression/Anxiety/Stress symptoms		
Energy / Nutrients		**No (n=126)**	**Yes (n=104)**	**p-value**
		Means (95% CI)		
Unadjusted models				
Energy intake (kcal/day)		1869 (1771; 1966)	1981 (1853; 2108)	0.166
Macronutrient intake (g/day)	Dietary Carbohydrate	237 (225; 249)	251 (237; 265)	0.114
	Dietary Fat	57 (55; 61)	54(52; 57)	0.068
	Dietary Protein	58 (56; 60)	56 (53; 59)	0.323
	Dietary Fibre	23 (21; 24)	26 (24; 27)	0.021
Minerals intake	Calcium (mg/day)	688 (645; 731)	572 (513; 631)	0.001
	Phosphorus (mg/day)	1027 (969; 1085)	972 (907;1037)	0.214
	Iron (mg/day)	8.61 (8.43; 8.79)	8.11 (7.86; 8.36)	0.001
	Zinc (mg/day)	8.85 (8.32; 9.38)	8.00 (7.57; 8.84)	0.120
Vitamins intake	Vitamin A (µgRE)	637 (599; 675)	594 (547; 642)	0.165
	Vitamin B1 (mg/day)	1.11 (1.09; 1.13)	1.08 (1.06; 1.11)	0.129
	Vitamin B2 (mg/day)	1.11 (1.07; 1.16)	1.06 (1.01; 1.12)	0.190
	Vitamin B3 (mg/day)	14.39 (13.88; 14.90)	13.13 (12.46; 13.80)	0.003
	Vitamin C	97 (89; 106)	104 (94; 114)	0.298
Food Variety score (FVS)		33 (31; 34)	27 (24; 29)	0.000
Adjusted models [a]				
Energy intake (kcal/day)		1809 (1741; 1854)	1875 (1713; 1908)	0.571
Macronutrient intake (g/day)	Dietary Carbohydrate	242 (212; 256)	256 (217; 271)	0.210
	Dietary Fat	55 (50; 59)	53 (51; 57)	0.217
	Dietary Protein	59 (55; 61)	54 (51; 60)	0.103
	Dietary Fibre	21 (20; 23)	26 (23; 28)	0.001
Minerals intake	Calcium (mg/day)	680 (661; 701)	579 (508; 640)	0.000
	Phosphorus (mg/day)	1020 (954; 1065)	967 (897;1011)	0.267
	Iron (mg/day)	8.59 (8.37; 8.59)	8.01 (7.77; 8.31)	0.000
	Zinc (mg/day)	8.81 (8.28; 9.35)	7.81 (7.47; 8.68)	0.050
Vitamins intake	Vitamin A (µgRE)	630 (577; 667)	591 (544; 637)	0.175
	Vitamin B1 (mg/day)	1.13 (1.10; 1.15)	1.12 (1.07; 1.14)	0.141
	Vitamin B2 (mg/day)	1.12 (1.08; 1.17)	1.05 (1.00; 1.11)	0.050
	Vitamin B3 (mg/day)	14.30 (13.79; 14.85)	13.01 (12.26; 13.75)	0.000
	Vitamin C	98 (89; 107)	100 (91; 109)	0.498
Food Variety score (FVS)		34 (31; 35)	26 (24; 29)	0.000

[a] adjusted for maternal age, parity, emotional support and monthly income

3.1.4. Factors Associated with Dietary Diversity (DD)

DD was evaluated in relation to factors such as antenatal DAS symptoms, socioeconomic factors and

emotional support (Table 4). Univariate regression analysis showed that low DD was more likely in the presence of antenatal DAS symptoms, low economic status, and poor emotional support during pregnancy, both from partners and family members. After simultaneous adjustment for the associated factors, women with DAS symptoms were nearly twice as likely to have low DD in comparison to the rest (1.98: 95% CI: 1.12; 3.47). Our findings indicate that psychological distress during pregnancy has the strongest influence on low DD, followed by family's income and emotional support by the husband. Figure 1 illustrates mean accumulative DAS score (95% CI) by quartile of FVS; concordant with the OR for DAS symptoms.

Table 4. Association of dietary diversity with maternal antenatal psychological status and socioeconomic factors (unadjusted & adjusted models)

Characteristics	Dietary diversity N (%)		Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
	High (n=100)	Low (n=130)				
Antenatal DAS symptoms	35 (35%)	69 (53%)	2.10 (1.23; 3.59)	0.007	1.98 (1.12; 3.47)	0.019
Maternal age (< 20 years)	23 (23%)	38 (29%)	1.38 (0.76; 2.52)	0.290	--	--
Monthly income (< Rs.15000/-)	43 (43%)	81 (62%)	2.19 (1.29; 3.73)	0.004	1.81 (1.04; 3.14)	0.026
Primiparas	33 (33%)	55 (42%)	1.48 (0.86; 2.56)	0.151	--	--
Living in joint family system	65 (65%)	90 (69%)	1.21 (0.69; 2.11)	0.498	--	--
Home status (rented)	19 (19%)	34 (26%)	1.52 (0.81; 2.85)	0.201	--	--
Poor "husband support"	42 (42%)	74 (57%)	1.83 (1.03; 3.09)	0.023	1.78 (1.02; 3.08)	0.041
Poor "family members support"	37 (37%)	67 (51%)	1.81 (1.06; 3.01)	0.025	--	--

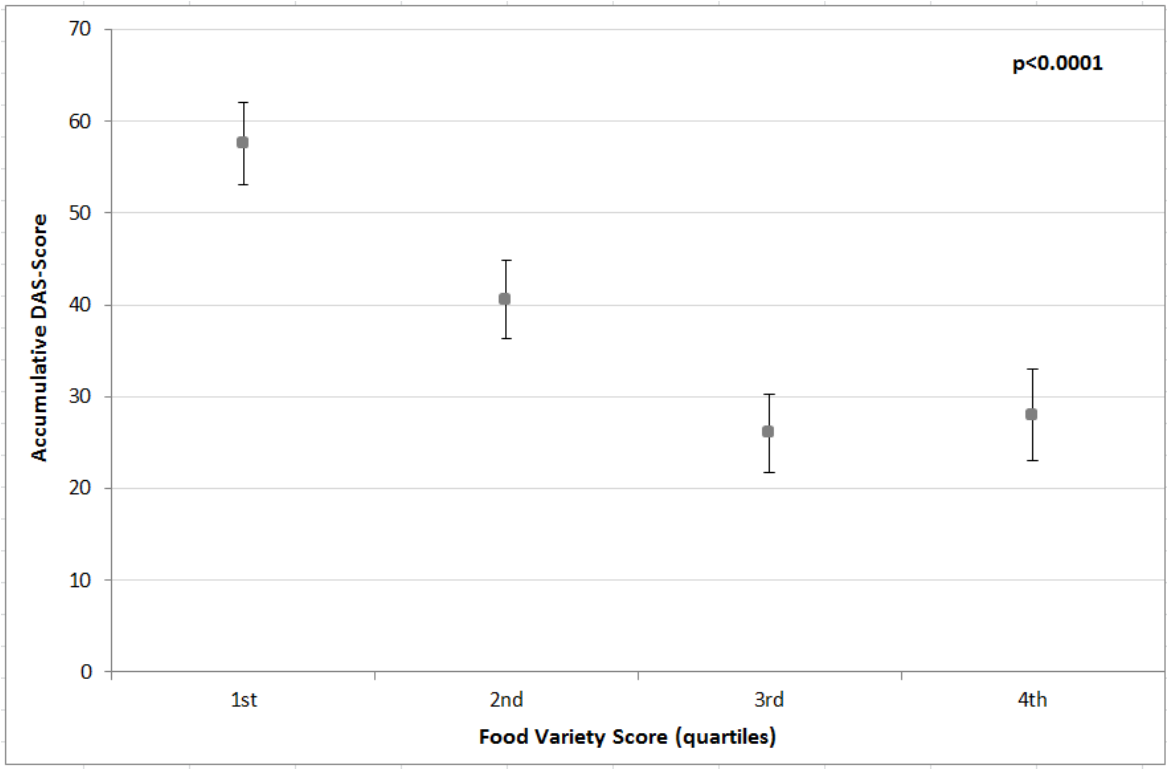

Figure 1. Mean accumulative DAS-score (95% CI) by quartile of FVS

3.2. Discussion

This study examined dietary intake in relation to psychological health in a cohort of pregnant women living in a semi-urban area of Peshawar region, North West Pakistan. We found no difference in energy and macronutrient intake between women with or without DAS symptoms. However there was evidence of a higher fibre intake and lower intakes of some key micronutrients such as calcium, iron and vitamin B3 and a less diverse diet in women with symptoms compared to those without. The multivariate analysis suggested that having DAS symptoms was independently associated with low dietary diversity. To our knowledge, this is the first explorative study that has attempted to look at the cumulative effect of depression, anxiety and stress on food and nutrients intakes and dietary diversity of pregnant women in Pakistan.

Women, from diverse socioeconomic backgrounds, seeking antenatal care services were selected and enrolled for the study; although numbers were small, there was a high compliance rate. Women were allocated to two groups based on their answers to validated scales used frequently for psychological testing. A high proportion of the women (45%) showed levels of symptoms above the cut-off in all three psychological domains and these women were compared to symptom free women. The number of pregnant women with symptoms was high; this could be attributed to factors such as the low overall socioeconomic status of the families and poor current maternal physiological status. These factors have been reported to be associated with various degrees of distress especially in the developing countries. Differences existed in several socioeconomic characteristics between the groups (Table 1). Distressed women were younger and more likely to be primiparas than those without DAS

symptoms ($p<0.05$). Previously, perinatal depression and anxiety have been shown to be higher in young [20,21] and primiparas mothers [20,22] from both developing and developed countries. Results on accommodation ownership, husbands' occupation and monthly income showed that distressed women were more likely to come from a lower socioeconomic background in comparison to those without symptoms. Low income has been consistently reported as a strong correlate of antenatal psychological distress [23,24]. Similarly, women with DAS symptoms were more likely to be living in a traditional extended or joint family system ($p<0.05$); this type of family structure has previously been found to be associated with perinatal depression and lower emotional support from the husband [25].

In this study some nutrient-rich foods such as milk, meat and fruit were consumed less often by the distressed women compared to those without DAS symptoms. Other studies have shown that psychological distress affects a person's mood and has an impact on dietary intake and preferences [26,27]. Psychological distress, particularly during pregnancy, has been previously reported to be associated with poor dietary intake, preferences or choices and imbalance dietary intake of energy and nutrients [1,28]. Unhealthy food choices include consumption of foods items which are high in energy but low in nutrient content [29,30]. Two studies which examined symptoms of depression [31] and anxiety [32] in a cohort of women in UK found that low intakes of fish in the diet were related to higher levels of symptoms in both these psychological domains. The author's suggested that this may be due to low intakes of dietary long-chain omega-3 fatty acids supplied by consuming fish. This type of fatty acid only comes from animal sources in the diet and in the current study the women with DAS symptoms had lower intakes of animal foods than those without symptoms. This low intake of long-chain omega-3 fatty acids may have contributed to their symptoms.

Differences in means dietary fibre intake between the groups became more marked after adjustment. These findings suggest that in comparison to women without DAS symptoms, women in the distressed group were likely to consume more plant foods rich in fibre as was shown by their greater consumption of vegetables. Furthermore, distressed women in the current study had lower mean dietary intakes of some minerals (calcium, iron, zinc) and vitamins (B2, B3) ($p<0.01$) in the adjusted analysis. This was likely to be due to their lower intakes of milk (calcium), meat (iron and zinc) and fruit. Previous studies have reported mixed findings on the relationship between psychological distress and dietary intakes. Some studies have found high stress to be associated with higher intakes of energy and macronutrients in the general population [33,34] and in pregnancy [1]. Another found high fat intake in females with high stress [35]. Conversely, Hyun et al. [36] and Bae et al. [37] reported that energy and macronutrients intakes were higher in low stressed than in high stressed pregnant women. Furthermore, Hurly et al. [1] reported that depressed and anxious pregnant women consumed on average higher amounts of macronutrients but lower amounts of micronutrients comparing to women with no symptoms of depression and anxiety and two other studies found that stressed mothers showed lower dietary intakes of micronutrients than control groups [38]. The current study is in line with these latter findings.

Our findings show that maternal antepartum poor psychological traits are an independent predictor of low dietary diversity irrespective of monthly income. Previous studies have shown that better diet quality is associated with a lower level of psychological symptoms not only during pregnancy [1] but also postpartum [4]. In general, women with lower levels of depressive symptoms have healthier dietary habits and consume meat, fruits and vegetables more frequently in comparison to women with depressive symptoms who are likely to consume refined/processed foods with higher frequency [1,39,40]. In one study on predominantly white, non-smoking, married and well-educated pregnant women, psychosocial factors of fatigue, stress, and anxiety were found to be associated with increased food consumption measured by increased macronutrient intake, but with decreased micronutrient intakes [1]. Thus women with psychological distress during pregnancy have shown very similar dietary behaviour in these different studies.

The current study has several strengths and limitations. This is the first study to examine the relationship between antenatal psychological distress and dietary intake in women from Pakistan. The research team was diverse and comprised of specialist nutritionist, gynaecologist, clinical psychologist, specialist palliative care nurses and social scientists. This mix of disciplines and backgrounds helped to evaluate the interdisciplinary research tools and brings a range of perspectives to the conduct of the study and the analyses. The participants' psychological health was assessed using Urdu-translated version of the well-respected DASS-42 questionnaire. This study also benefited from the availability of data on potential confounding factors. All data were collected by trained interviewers via face to face interviews. Diet was collected by a carefully designed food frequency questionnaires which covered foods normally eaten in the study area. Trained staff used standardised methods to calculate nutrient intakes from the dietary data and used nutrient analysis tables appropriate to Pakistan.

One major limitation of our study is that our cohort of women was recruited in one geographical area of Pakistan therefore cannot be generalized to all pregnant women in Pakistan; however it is likely to be reasonably representative of women in the North West region of Pakistan. Generally, people living in the North West region, have different customs, food and health attitudes, dietary behaviours and social life characterises [41,42] in comparison to other regions of Pakistan. Women were enrolled in their third trimester of pregnancy, so health measurements in the initial stage of pregnancy could not be taken by our team. However, data on women's health status during the initial stage of pregnancy were extracted from the hospital records but are limited in their scope. Diet was assessed at only one time point in late pregnancy and may not represent the whole of pregnancy. The cross-section nature of the study is another limitation; this type of study cannot be used to derive causal conclusions.

4. Conclusions

In conclusion, dietary diversification has been recommended in the past few decades because dietary

variety ensures an adequate intake of essential nutrients [43] and hence promotes better health. Worldwide the dietary status of women is inadequate and among women of childbearing age from developing countries, this is linked to an inadequate consumption of fruits, meat, and food of animal origin [44]. In this study poor antenatal psychological health was a stronger determinant of poor dietary variety than economic status. Our results suggest that although low income may affect access to a good quality diet is not the only factor associated with low dietary diversity. Therefore, account should be taken of women's psychological health when assessing barriers to the consumption of a good quality diet.

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