Parental perceptions of their child's weight and future concern: The Pacific Islands Families Study

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Abstract

Aim: *Little is known about the perception of overweight, expressed as a level of concern, of Pacific parents and its relevance to children's weight. The aim of this study was to analyse data collected at birth and four and six years in the Pacific Island Families Study (PIFS) to investigate the relationship between parental perceptions of child weight status and actual weight status.*

Method: *A total of 569 parent child dyads (299 boys (52.5%), 270 girls (47.5%); 47.1% Samoan, 20.9% Tongan, 18.6 % Cook Island, 4.9% Niue, 8.4% other Pacific) were examined in this Parental Perception of Overweight Obesity Study (PPOS). At four and six years the question was asked of the parent "How concerned are you about your child becoming overweight?" A 5-point Likert scale was used, with possible answers ranging from "unconcerned" through increasing levels of concern to "very concerned". At four and six years weight and height were also measured and body mass index (BMI) derived and classified using international standards. Potential factors associated with parental perception were examined in a multivariate model using logistic regression.*

Results: *The majority of parents were unconcerned at four and six years (62% and 69.1%) about the future overweight status of their child. Using the international BMI classifications, at four years 40.1 % of the children were classified as normal weight, 34.1% as overweight, and 25.8% as obese. At six years the proportions were similar; i.e., normal 41.3%, overweight 31.1%, and obese 27.6%. At four and six years the proportion of parents who were concerned about their child's future weight status was related to the child weight status e.g., at 6 years 20% of parents of normal children, 28% percent of parents of overweight and 51% of parents of obese children were concerned (p trend <0.0001). Ethnicity and parity were significantly related to parental perceptions (p<0.0001); identification with Tongan ethnicity was related to a higher proportion of concerned parents and an increased number of children in the family were related to a smaller proportion of concerned parents.*

Discussion: *While the level of concern was low and the prevalence of overweight and obesity high, the context of the socio economic and demographic environments must be taken into account in the formulation of interventions. Overweight and obese Pacific children may benefit from interventions that target the awareness of parents, making them more conscious of the relationship of obesity with food and activity patterns and give practical support to change the environment. These findings raise the concern that there is a normalisation of overweight and obesity in Pacific parents and/or children. Interventions firstly should address the socio economic demographic environment of a Pacific family making healthier choices the easier choices.*

Introduction

The prevalence of extreme obesity within Pacific children was reported to be 11 times greater than European children,[1] and more than half of Pacific children aged 5-14 years were either overweight or obese in national surveys in 2002 and 2006/2007.[2] This is concerning because being overweight and/or obese is a risk factor for many cardiovascular diseases (CVD), cancers, and diabetes.[3-5] Pacific people have a higher prevalence and a younger age of onset for CVD, stroke, some cancers, and diabetes compared to other ethnic groupings within the New Zealand population.[6] Furthermore, being overweight and/or obese in childhood increases the likelihood of being overweight or obese in adulthood.[3, 4]

While there is much international literature on parental perceptions of child weight, knowledge on Pacific parental perception of child weight status is scarce. There is a need to explore the parental perceptions of different ethnic groups, and more so if particular ethnic groups exhibit unequally high numbers of overweight and obese children.[8-10]

Parents have great influence on their child's immediate environment, influencing the nutritional, physical, social, and cultural interactions that the child is subjected to.[11] The child's health (including weight status and wellbeing) can be linked to the influences the parents have on them, including for instance, the influence of the food environment.[12] An area which has increasingly become of importance is the contributions parental perceptions have on influencing the child's food environment and on child weight.[13]

Parents may unknowingly reinforce an obesogenic environment for their child if they fail to perceive that their child is overweight and or obese. However parents' ability to provide a healthier food environment is heavily dependent on their own physical and social environment.[14]

Using longitudinal data from the Pacific Island Families study (PIFS), this sub study sought to determine if Pacific parental perception about overweight of their child at both 4 and 6 years of age was associated with the actual weight of the child measured at the same time. The sub study was named the Parental Perception of Overweight Obesity study (PPOS). Associations of perceptions of overweight and obesity with behaviours and the environment need to be understood better to be able to design specific Pacific obesity prevention efforts. This research aims to examine whether Pacific parental (majority are mothers) perception (concern) of their child's weight status (normal/overweight/obese) is accurately associated with their actual weight, and to identify factors related to parental perceptions.

Methods

A detailed explanation of study design, recruitment (n=1171), sampling and other methodologies is reported previously in this journal and elsewhere.[15] For this present investigation children of multiple birth status, and/or of low birth weight (<2500 grams), pre-term (≤37 weeks), and with a mother with gestational diabetes were excluded because all these will affect the growth of the child. Only child mother pairs who had both body size (height and weight) and parental perception measurements in 2004 and 2006 were included. In all, 569 child-mother dyads met the measurement criteria at both four and six years. Socio-cultural variables recorded at birth included sex, acculturation, ethnicity, maternal age (at birth), education, household income, parity, maternal smoking status, usual number of people residing in the house, and infant feeding practices. The final study sample is modelled in consort diagram Figure 1.

Parental perception for the purpose of this paper was defined as the level of concern that parents hold regarding their child becoming overweight in future.[16] The parental perception question was extracted from the Child Feeding Questionnaire (CFQ), which is a self report measure to assess parental belief, attitudes and practices regarding child feeding, with a focus on obesity proneness in children.[17] This question was specifically designed to assess a parent's perceptions and concerns regarding childhood obesity and is considered appropriate for parents of normally developing school aged children. The question used to measure this domain was: *'How concerned are you about your child becoming overweight'*. The four available responses to this question were - unconcerned, concerned, fairly concerned and very concerned. For analyses in this paper, this variable was dichotomised in to concern (that combined all concerned variables) and unconcerned.

Ethical approval for each stage of the PIFS was obtained from the Auckland Branch of the National Ethics Committee (First Two Years of Life Phase at 6 weeks, 12 months, 24 months): AIT801, and the Transition to School Phase (4 years, 6 years): AITX0202.

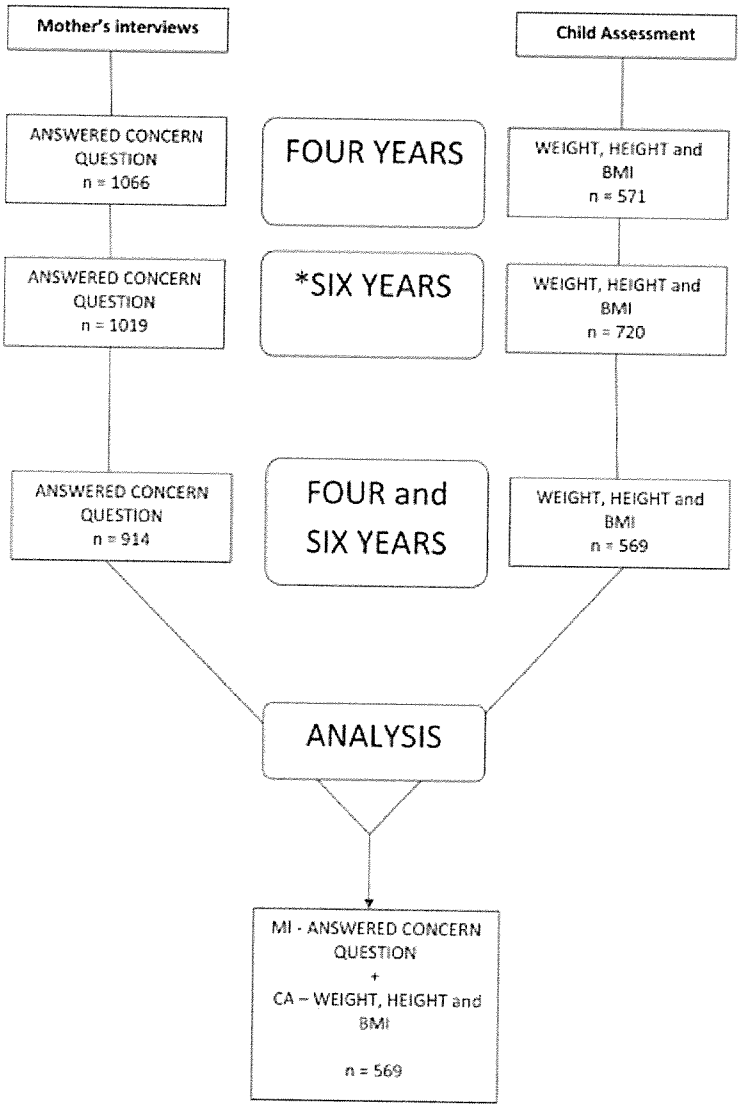


Figure 1. Inclusion criteria for Parental perception of Obesity Study (PPOS)
MI = mother interview, CA = child assessment, n = number

At four and six years of age, anthropometric measurements (height, weight) were made in duplicate and repeated a third time if not within 0.1 kg for weight and 0.5cm for height. Child weight was measured in light clothing to the nearest 0.1 kg. Children were asked to remove their shoes before their standing height was measured to the nearest 0.1 cm. Child BMI was calculated as (kg)/ $(m)^2$. Child age was determined as the difference between the date of measurement and the date of birth. At 4 and 6 years Cole cut-offs were used to determine body size categories of thinness, normal, overweight and obese.[18] The body size categories were determined with an Excel™ add-in kindly supplied by Professor Tim Cole, University College, London. Continuous statistics are presented as mean, standard deviation and minimum and maximum values. Descriptive categorical statistics are provided as frequencies and percentages and 95% confidence intervals (95%CI) calculated. Chi squared statistic and the univariate odds ratio model were used to examine for meaningful differences and associations.

Results

Comparison of demographic and socioeconomic factors between the sub sample PPOS and the parent PIFS at six weeks postpartum found that there were no significant differences in age, ethnicity, or cultural alignment of the mother inferring that the PPOS is a representative sub-sample of the PIFS cohort. It is important to note that the profile of the PIFS cohort also shows a high proportion have demographic and social factors that are evidence of low socio economic status which is reflective of New Zealand's Pacific population generally. Demographic, socio-economic, and lifestyle factors of the PPOS are presented in Table 1.

Table 1. Demographic characteristics of Mothers

Demographic Characteristic	**Included sample n=569 n (%)**
Age	
< 20 years	38 (6.7)
20 - 29 years	276 (48.5)
30 – 39 years	229 (40.2)
40 + years	25 (4.4)
Missing	1 (0.2)
Ethnicity	
Samoan	268 (47.1)
Cook Island	106 (18.6)
Niuean	28 (4.9)
Tongan	119 (20.9)
Other Pacific	10 (1.8)
Non-Pacific	38 (6.7)
Cultural alignment	
Assimilator	185 (32.5)
Separator	187 (32.9)
Integrator	98 (17.2)
Marginal	93 (16.3)
Missing	6 (1.1)
Social marital status	
Partnered legally married	345 (60.6)
Partnered defacto	125 (22.0)
Non-partnered	99 (17.4)
Education	
No formal qualifications	200 (35.1)
Secondary school qualifications	211 (37.1)
Post-school qualifications	158 (27.8)
Household income (annual)	
$0-$20 000	181 (31.8)
$20 001-$40 000	297 (52.2)
$> 40 000	74 (13.0)
Unknown	17 (3.0)
Smoked during pregnancy	
Yes	127 (22.3)
No	437 (76.8)
Missing	5 (.9)
Birth parity	
1	135 (23.7)
2-4	328 (57.6)
5	106 (18.6)

Level of Concern

The majority of parents responded that they were 'unconcerned' with regard to their child's weight (Table 2). There was a marginal decrease (6.7%) in the number of parents concerned from 2004 and 2006. There were significant differences in levels of concern based on ethnicity. Tongan mothers did not follow the same pattern of concern as the other major ethnic groups. For instance, Tongan parents showed the highest levels of concern at both time points and were the only group that reported an increase in concern from four to six years. From four to six years, their level of parental concern almost doubled (47.1% to 79.8%). All other ethnic groups' levels of concern decreased on average by 46%. There were no differences in the pattern of concern by child's gender.

Table 2. Parental perception as a level of concern regarding child becoming overweight in future at four and six years by child ethnicity (n = 569).

Child Ethnicity	2004		2006	
	Concerned	Unconcerned	Concerned	Unconcerned
	n (%)	n (%)	n (%)	n (%)
Samoan	89 (33.2)	179 (66.8)	46 (17.2)	222 (82.8)
Cook Island	41 (38.7)	65 (61.3)	19 (17.9)	87 (82.1)
Tongan	56 (47.1)	63 (52.9)	95 (79.8)	24 (20.2)
Other Pacific	17 (44.7)	21 (55.3)	9 (23.7)	29 (76.3)
Non Pacific	11 (28.9)	27 (71.1)	7 (18.4)	31 (81.6)
Total	214 (37.6)	355 62.4)	176 (30.9)	393 (69.1)
	p=0.066		p=<0.001	

Note. p value derived from chi square test. p value is with regard to difference between concerned & unconcerned by ethnic group for each year

Results from the univariate analyses showed that Tongan mothers, non-smoking mothers, and mothers who were married (rather than in a de-facto relationship or single mothers) were significantly more likely to be concerned for the future weight status of the child (Table 3). In multivariable analyses, only Tongan ethnicity of mothers remained significant and parity became significant, whereby with increasing parity there was decreased likelihood of concern.

Table 3. Univariate and Multivariate logistic regression of parental perception expressed as a level of concern at six years on selected socio economic demographic characteristics of mother and child from birth (6 weeks postpartum) (n = 569).

		Univariate odds ratio		Multivariate odds ratio	
Variable	**Category**	**OR**	**(95% CI)**	**OR**	**(95% CI)**
Sex of child	Male	1.0	-	1.00	-
	Female	1.02	(0.71, 1.45)	0.83	(0.53, 1.31)
Acculturation	Assimilator	1.0		1.00	-
	Separator	1.47	(0.95, 2.29)	0.75	(0.39, 1.48)
	Integrator	1.14	(0.66, 1.95)	0.95	(0.47, 1.90)
	Marginalist	1.29	(0.75, 2.21)	0.72	(0.35, 1.47)
Mother's ethnicity	Samoan	1.0	-	1.00	
	Cook Island	0.91	(0.45, 1.86)	0.91	(0.45, 1.86)
	Tongan	22.93	(12.38, 42.49)***	22.93	(12.38, 42.49)***
	Other Pacific	1.60	(0.64, 3.99)	1.60	(0.64, 3.99)
	Non Pacific	0.99	(0.37, 2.68)	0.99	(0.37, 2.68)
Education	No Formal Education	1.0	-	1.00	-
	Secondary School	1.18	(0.78, 1.79)	1.13	(0.65, 1.97)
	Post school	0.93	(0.59, 1.47)	0.88	(0.48, 1.63)
Smoking in pregnancy	No	1.0	-	1.00	-
	Yes	0.51	(0.32, 0.82)**	0.91	(0.51, 1.63)
Marital status	Married	1.00	-	1.00	
	De-facto	0.49	(0.31, 0.79)**	1.08	(0.58, 2.00)
	Single	0.43	(0.25, 0.73)**	0.63	(0.29, 1.37)
Mother's age	<20 years	1.0	-	1.00	-
	20 – 29 years	1.34	(0.61, 2.95)	1.42	(0.54, 3.73)
	30 – 39 years	1.76	(0.80, 3.91)	2.42	(0.86, 6.85)
	40 years +	0.81	(0.24, 2.76)	0.77	(0.16, 3.65)
Household income	$0 - $20,000	1.00	-	1.00	-
	$20,001 - $40,000	1.07	(0.72, 1.60)	0.76	(0.42, 1.38)
	$40,000 +	1.13	(0.63, 2.02)	0.65	(0.29, 1.44)
	Unknown	0.98	(0.33, 2.92)	0.63	(0.15, 2.59)
Parity	1	1.00	-	1.00	-
	2-4	0.75	(0.49, 1.15)	0.52	(0.30, 0.92)*
	5+	0.92	(0.54, 1.58)	0.32	(0.14, 0.77)*
Household size	2-4	1.00	-	1.00	-
	5-7	1.16	(0.73, 1.85)	1.25	(0.69, 2.26)
	8+	1.22	(0.73, 2.02)	1.68	(0.86, 3.27)

Levels of significance * p <0.05, **p<0.01, ***p<0.0001

Weight Status

Although not significantly different, the Other Pacific ethnic group had the highest proportion of children in the normal weight category at both 2004 and 2006 (53.4%, and 57.0%). The highest prevalence of underweight/normal weight reported in 2004 and 2006 was in the Cook Island ethnic group (39.6% and 41.5%, respectively). From four to six years the distribution amongst weight categories generally remained constant within ethnicity, with the exception of the Cook Island ethnic group, which showed a non-significant shift of approximately 10% moving from the overweight category to the obese category. This shift means that the Cook Island group became more similar to the other groups rather than having fewer obese children as was observed at four years (Table 4).

Table 4. Child weight status at four and six years by ethnicity and sex (n = 569)

	2004			2006		
	Normal	Overweight	Obese	Normal	Overweight	Obese
Ethnicity	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Samoan	101 (37.7)	93(34.7)	74 (27.6)	104 (38.8)	91 (34.0)	73 (27.2)
Cook Island	42 (39.6)	42(39.6)	22(20.8)	44 (41.5)	30 (28.3)	32 (30.2)
Tongan	44 (37.0)	37 (31.1)	38 (31.9)	48 (40.3)	35 (29.4)	36 (30.3)
Other Pacific	41 (53.9)	22 (28.9)	13 (17.2)	49 (57.0)	21 (24.4)	16 (18.6)
Total	228 (40.1)	194 (34.1)	147 (25.8)	235(41.3)	177(31.1)	157(27.6)
		p=0.074			p = 0.416	
Sex	Normal	Overweight	Obese	Normal	Overweight	Obese
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Male	118 (39.5)	96 (32.1)	85 (28.4)	118 (39.5)	90 (30.1)	91 (30.4)
Female	110 (40.7)	98 (36.3)	62 (23.0)	117 (43.3)	87 (32.2)	66 (24.4)
Total	228 (40.1)	194 (34.1)	147 (25.8)	235 (41.3)	177 (31.1)	157 (27.6)
		p=0.297			p=0.277	

Note. p value derived from chi square test.

Results of the univariate analyses showed that the odds of children being classified as overweight or obese decreased if their mothers were non-Pacific or if the child was of a Pacific ethnicity other than Samoan, Cook Island, Tongan or Niuean, or if the household income was of a certain level ($20,001-$40,000, income not declared), or had many siblings (2-4 children) (Table 5). Caution should be taken in the interpretation of the significance of the odds for non-Pacific mothers, other-Pacific children and unknown household income results as the sample sizes for each of the categories was small.

Table 5. Univariate & Multivariate logistic regression of child being overweight or obese (n = 569) analysed against selected socio- economic demographic characteristics of mother and child from birth (6 weeks postpartum).

		Univariate odds ratio		Multivariate odds ratio	
Variable	**Category**	**OR**	**(95%, CI)**	**OR**	**(95%, CI)**
Sex of child	Male	1.00	-	1.00	-
	Female	0.85	(0.61,1.19)	0.77	(0.51,1.16)
Acculturation	Assimilator	1.00	-	1.00	-
	Separator	1.39	(0.92, 2.1)	0.91	(0.49,1.67
	Integrator	1.43	(0.87, 2.36)	1.15	(0.61,2.16
	Marginalist	1.38	(0.83, 2.29)	1.57	(0.85,2.92
Mother's ethnicity	Samoan	1.00	-	1.00	-
	Cook Island	0.89	(0.57, 1.41)	0.76	(0.44, 1.33)
	Tongan	0.94	(0.60, 1.46)	0.99	(0.61, 1.59)
	Other Pacific	0.78	(0.40, 1.55)	0.68	(0.31, 1.47)
	Non Pacific	0.46	(0.23, 0.92)**	0.49	(0.22, 1.08)
Child's ethnicity	Samoan	1.00	-	1.00	-
	Cook Island	0.89	(0.57, 1.41)	0.95	(0.51, 1.78)
	Niuean	0.73	(0.34, 1.60)	0.74	(0.81, 6.67)
	Tongan	0.94	(0.60, 1.46)	0.39	(0.21, 0.75)***
	Other Pacific	0.54	(0.29, 0.99)**	0.37	(0.12, 1.12)
Education	No Formal Education	1.00	-	1.00	-
	Secondary School	0.88	(0.59, 1.30)	1.30	(0.79, 2.15)
	Post school	0.85	(0.55, 1.29)	1.18	(0.67, 2.06)
Smoking during pregnancy	No	1.00	-	1.00	-
	Yes	1.31	(0.87, 1.96)	1.56	(0.98, 2.50)
Marital status	Married	1.00	-	1.00	-
	De-facto	0.86	(0.57, 1.30)	0.88	(0.54, 1.45)
	Single	1.17	(0.74, 1.86)	0.79	(0.43, 1.46)
Mother's age	<20 years	1.00	-	1.00	-
	20 – 29 years	0.61	(0.29, 1.26)	0.94	(0.39, 2.25)
	30 – 39 years	0.71	(0.34, 1.49)	0.83	(0.32, 2.15)
	40 years +	0.43	(0.16, 1.21)	1.69	(0.47, 6.03)
Household income	$0 - $20,000	1.00	-	1.00	-
	$20,001 - $40,000	0.63	(0.43, 0.92)**	0.61	(0.38, 0.99)*
	$40,000 +	0.71	(0.41, 1.23)	0.72	(0.38, 1.39)
	Unknown	0.36	(0.13, 0.98)**	0.39	(0.13, 1.18)
Parity of mother	1	1.00	-	1.00	-
	2-4	0.62	(0.41, 0.94)**	0.54	(0.34, 0.87)*
	5+	0.73	(0.43, 1.24)	0.57	(0.29, 1.14)
Usual number in the House	2-4	1.00	-	1.00	-
	5-7	1.30	(0.85, 1.99)	1.38	(0.79, 2.39)
	8+	1.54	(0.96, 2.47)	1.25	(0.68, 2.32)

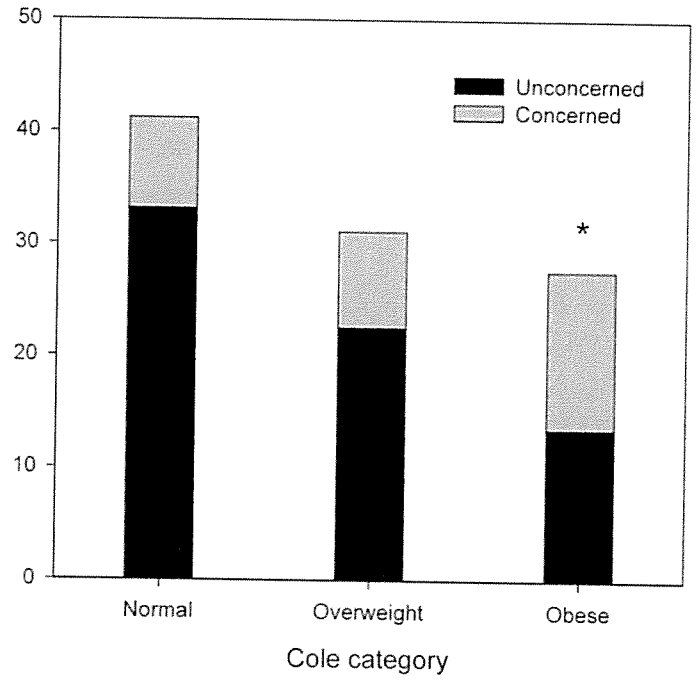
Levels of significance * $p<0.05$, ** $p<0.01$, *** $p<0.0001$

To adjust for potential confounding effects, all variables were used in a multiple logistic regression model (Table 4). When controlling for the effects of all other variables, the effect of mother's ethnicity (non-Pacific), child's ethnicity (other Pacific), and unknown level of household income failed to remain significant (Table 5). Ethnicity of the child became a significant factor, whereby if the child was Tongan, they were significantly less likely of being overweight or obese at six years. Parity and household income remained significant factors ($p<0.05$).

Associations between Weight Status & Parental Concern

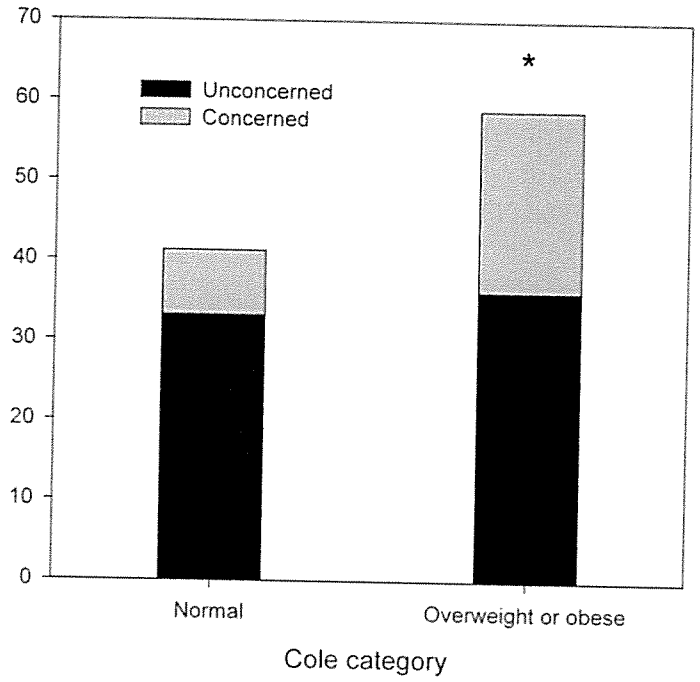
Figure 2 presents the weight status distribution of the children at age six years according to the IOTF grade[19] and the level of parental concern (unconcerned, concerned) shown by parents at six years. The proportion of concerned parents increased as the weight status category increased and was significant for trend ($p<0.0001$). For normal weight children, one in five (20%) parents were concerned for their child's overweight status; for overweight children approximately one in four (28%) parents were concerned; and for obese children, one in two (51%) parents were concerned. This trend was similar at four years.

Figure 2. Prevalence of parental perception (concern, unconcerned) at six years of normal, overweight and obese. (n=569) and child's weight status at age 6 years.



*p<0.0001 Chi squared test compared with normal.
p trend <0.0001

Figure 3. Prevalence of parental perception (concern, unconcerned) at six years normal and overweight and or obese (n=569) and child's weight status at age six years.



*p<0.0001 Chi squared test compared with normal.

Figure 3 combines the overweight and obese children at age six according to the IOTF grade into one category (overweight and obese).[19] The proportion of concerned parents of children normal for weight status is at 20% (meaning on average, one in five parents of normal children are concerned for their child's overweight status) while the proportion of parents concerned for the overweight status of their overweight/ obese child is almost double at 39% (two in every five).

Socio economic and demographic moderators of parental perceptions and body size

Children normal for weight according to the IOTF grades[19] at age six years were removed from the following univariate and multivariate logistic regression analysis (Table 6) to explore the relationship between parental perception expressed as a level of concern (unconcerned, concerned) at six years, and overweight and obese weight status at age six. Socioeconomic demographic characteristics of both mother and child at baseline (six weeks postpartum) and parental perception (concern, unconcerned) at six years were included in the univariate logistic regression analysis. From univariate analyses the odds of parents of overweight and obese children being concerned for child's future overweight status increased if the mother or the child was Tongan. The odds of mothers being unconcerned for their child's future overweight status was strengthened if the mother had smoked during pregnancy or if the mothers were in an unstable relationship with their spouse at birth (six weeks postpartum) (Table 6).

Table 6. Univariate and multivariate logistic regression of parental perception expressed as a level of concern at six years (n=569) for overweight and obese children

Variable	Category	Univariate odds ratio		Multivariate odds ratio	
		OR	(95% CI)	OR	(95% CI)
Sex of child	Male	1.0	-	1.00	-
	Female	0.90	(0.58 1.40)	0.64	(0.37, 1.10)
Acculturation	Assimilator	1.0		1.00	-
	Separator	1.26	(0.73, 2.20)	0.91	(0.41, 2.0)
	Integrator	1.19	(0.61, 2.29)	1.29	(0.57, 2.94)
	Marginalist	1.24	(0.63, 2.42)	0.88	(0.38, 2.08)
Mother's ethnicity	Samoan	1.0	-	1.00	-
	Cook Island	0.98	(0.50, 1.91)	0.88	(0.38, 2.04)
	Tongan	11.46	(5.80, 22.62)***	14.00	(6.48, 30.22)***
	Other Pacific	1.41	(0.53, 3.72)	1.71	(0.56, 5.21)
	Non Pacific	1.69	(0.58, 4.92)	2.11	(0.61, 7.30)
Child's ethnicity	Samoan	1.0	-	1.00	-
	Cook Island	0.98	(0.50, 1.91)	0.88	(0.38, 2.03)
	Niuean	1.02	(0.31, 3.38)	1.13	(0.29, 4.33)
	Tongan	11.46	(5.80, 22.62)***	13.74	(6.37, 29.63)***
	Other Pacific	1.95	(0.78, 4.88)	2.10	(0.61, 7.28)
Education	No Formal Education	1.0	-	1.00	-
	Secondary School	1.15	(0.69, 1.92)	1.07	(0.56, 2.05)
	Post school	0.96	(0.54, 1.68)	0.97	(0.47, 1.99)
Smoking in pregnancy	No	1.0	-	1.00	-
	Yes	0.52	(0.30, 0.90)*	0.80	(0.42, 1.60)
Marital status	Married	1.00	-	1.00	-
	De-facto	0.53	(0.30, 0.95)*	1.06	(0.50, 2.23)
	Single	0.42	(0.22, 0.79)**	0.67	(0.28, 1.65)
Mothers age	<20 years	1.0	-	1.00	-
	20 – 29 years	1.28	(0.53, 3.14)	1.50	(0.49, 4.53)
	30 – 39 years	1.71	(0.70, 4.20)	2.74	(0.82, 9.19)
	40 years +	1.13	(0.26, 4.85)	1.07	(0.17, 6.74)
Household income	$0 - $20,000	1.00	-	1.00	-
	$20,001 - $40,000	1.30	(0.80, 2.12)	0.85	(0.43, 1.71)
	$40,000 +	1.39	(0.68, 2.83)	0.75	(0.29, 1.92)
	Unknown	2.57	(0.55, 12.03)	1.45	(0.23, 9.26)
Parity	1	1.00	-	1.00	-
	2-4	0.80	(0.48, 1.35)	0.60	(0.31, 1.16)
	5+	0.84	(0.44, 1.63)	0.30	(0.11, 0.82)*
Household size	2-4	1.00	-	1.00	-
	5-7	1.22	(0.67, 2.22)	1.50	(0.73, 3.11)
	8+	1.13	(0.60, 2.15)	1.89	(0.84, 4.26)

The reference category for the logistic regression was 'Unconcerned'.
Levels of significance * $p<0.05$, ** $p<0.01$, *** $p<0.0001$

To adjust for potential confounding effects, all variables in Table 6 were simultaneously entered into a multiple logistic regression model. When controlling for the effects of all other variables, the effect of smoking during pregnancy and marital status failed to remain significant. Ethnicity for both mother and child remained significant, whilst the parity of the mother became significant. The odds of mothers being concerned for their child becoming overweight and/or obese child at 6 years increased if the mother and/or the child were of Tongan descent. The odds of mothers being unconcerned strengthened if they had five or more children (at the time of the child's birth).

Discussion

Key findings

Although six out of ten Pacific children were overweight or obese, only four out of ten Pacific parents were unconcerned about their child becoming overweight. For the Pacific children classified as overweight or obese, three out of five of their parents were not concerned about their child becoming overweight. Socioeconomic and demographic lifestyle factors were found to significantly influence the perception Pacific parents had of their child's future weight status. Tongan parents were more likely to be concerned about their child becoming overweight. Tongan children were also less likely to be overweight or obese at six years postpartum. Greater parity decreased the level of concern parents had about the child becoming overweight. Children who had 2-4 siblings were less likely to be overweight or obese than children with no siblings. Pacific Children were less likely to be overweight and/or obese in households with a combined total income of between $20,000-$40,000 compared to the lower household income bracket of 0-$20,000.

Parental perceptions – Four to six years

Consistent with international findings, there was an apparent lack of concern shown by mothers of the PPOS with regards to the future overweight status of their child. At six years, the majority of parents (69.1%) were unconcerned about their child becoming overweight. The lack of concern appeared to track across time with a similar pattern observed at four years, where 62.4% of parents were unconcerned.

Contrary to usual trends reported in the literature, where the concern of parents increased as their child aged[20, 21] overall concern levels of the parents of the PPOS decreased by 6.7% from 2004 to 2006. There was one exception in Tongan mothers, whose levels of concern regarding their child's weight increased two fold over two years. Tongan children were found to be significantly less likely to be overweight or obese at 6 years old in multivariate analyses which may be a consequence of greater parental concern.

The sex of the child has been known to play a role in determining the perception of the parents.[22] In this study however, the sex of the child was not associated with any differences in levels of concern parents had for their child's weight.

Socioeconomic and demographic lifestyle factors found to be significant in influencing the perception of parents included ethnicity and parity. Previous research with Pacific populations found that Tongans, relative to the other Pacific groupings tend to feature within the upper limits of negative health measures.[23] The finding that Tongan mothers were most likely to be concerned for their child's future may be a consequence of higher level of awareness /morbidity due to overweight and obesity and the resulting assertion that these parent have in protecting their children from the negative consequences of overweight and obesity.

Body Weight status – Four to six years old

The weight status of the children in the PPOS showed similar patterns observed in

The National Children's Nutrition Survey (2002), the New Zealand Health Survey (2006/2007), and the PIFS. Although the prevalence of overweight and obese children remains high in PPOS/PIFS, it has at least appeared to have stabilised between the two time points as demonstrated in national surveys.[2,6] Measured using international standards,[19] six out of ten children were found to be overweight or obese at both four and six years.

Parental perception and child weight status

Given that the prevalence of overweight and obesity is high amongst Pacific children at four and six years of age, and the parental concern of Pacific parents is low it is inevitable that a level of discordance between the perception and actual weight status would emerge. At six years, for children classified as overweight or obese, three out of five of their parents (or 60%) were not concerned about their child becoming overweight. For the children classified as normal/underweight, one out of five parents (or 20%) was concerned about their child becoming overweight. The pattern was present at the four year measures also. There have been a number of studies worldwide which have also looked at the level of parental concern, and have found that parents from different ethnicities show a lack of concern for their child becoming overweight in future. It seems that the lack of concern shown by the parents of the PPOS is not an isolated phenomenon.[20,24] As stated, the concern of parents was reflective of the weight status of their child. As BMI SD z-scores and BMI weight classification increased, the proportion of parents concerned at both four and six years increased, with the proportion of concerned parents of overweight and obese children being twice that of the proportion of concerned parents of normal children. This pattern shows that parental concern has a positive relationship with the weight category/status of the child. However, the set point at which this relationship functions may differ between population groups.

A study conducted in Great Britain that assessed the parental concern of their 3-5 year old children's future weight status found that although 26% of these children were overweight or obese a considerably higher proportion of their parents reported that they were concerned for their future weight status (47%). In contrast the PPOS found that although 59% of children were overweight or obese only 31% of their parents reported any concern. Of obese children, 76% of parents were concerned compared to 50% of obese children in the PPOS study.[20] This stark difference could highlight potential cultural differences may affect perceptions, where larger bodies may be more tolerated within Pacific communities. However the higher level of concern shown by Tongan parents and significantly lower level of overweight and obesity of Tongan children does not support this prospect – especially considering that the Tongan ethnic group is the most recently established Pacific group in New Zealand. It may be that current weight perceptions of weight have changed in the PIFS parents resulting in the normalisation of a higher body weight.

The influence of socioeconomic and demographic lifestyle factors on both the weight status of children and parental perception was investigated. Multivariable analysis of the influence of socio demographic variables on the weight status of the children revealed that ethnicity of the child (Tongan), higher household income ($20,001-$40,000 compared to ≤$20,000) and higher parity (two and four children compared to one child) were protective factors for children of the PPOS being obese or overweight. An investigation that focused on factors related to food security of the PIFS cohort [25] found that an increased number of children (parity) was identified as an added environmental stressor among Pacific families, however, in times of

greater financial constraint Pacific families with higher parity would purchase more nutritious foods. This behaviour adheres to the Tongan concept of *faka-potopoto* or *fusi mo'omo*, whereby in times of financial hardship and scarce resources, the purchasing of food is managed more wisely to fit the demands of the occupants of the household. This may explain why those children who are from families of higher parity were less likely to be overweight or obese. Multivariable analysis was performed to assess the influence of socioeconomic demographic measures in moderating parental perception. Again a significant association was found with ethnicity. Tongan (mother and child) ethnicity increased the odds of parents being concerned for their child's future overweight status. Higher parity lowered the level of parental concern for their child's future weight status. The dependency ratio of larger families would suggest that parents may be under a number of socio environmental pressures and given that average household incomes of the Pacific families are relatively low, mothers with higher parity may be too stressed worrying about other things which may not allow them to pay sufficient attention with regard to their child's weight. It is interesting to note that that higher parity lowers the likelihood of a child being overweight or obese, and also lowers the likelihood of the parent showing concern for their child's weight generally when assessing overweight and obese children only.

Conclusions

Parental concern offers insight into the level of understanding that the parents have with regards to the association between weight status and health. Parental concern observed in this study over a period of two years revealed that Pacific parents become less concerned for their child's future weight status with time. The majority of Pacific children and Pacific mothers in this study were either overweight or obese. The findings suggest that in line with international literature, Pacific parents may not be fully aware of the relationship between the development of adulthood co-morbidities and the child's overweight status. Other stressors may influence Pacific parents' ability to distinguish between the different categories of child weight status, such as socioeconomic environmental pressures which may mean weight status of the child may not be a priority. The prevalence of overweight and obesity amongst Pacific children, mothers and their families are high, which may be caused by a shift in population ideals of weight status, normalising higher body mass.

The findings of the PPOS show that the trajectory for obesity becomes more acute through the child's lifecycle so that obesity amongst Pacific populations becomes intergenerational and endemic. Measures to combat Pacific poor health must aim to break this cycle.

This study in the context of the life course model identifies many opportunities for intervention to change the perception of Pacific parents from being unconcerned to being concerned for child weight status. The association between parental perception and socioeconomic demographic measures are an important starting point for the health sector to consider implementation to affect change to address and reduce the prevalence of overweight and obesity amongst Pacific children.

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"Do we not all agree to call rapid thought and noble impulse by the name of inspiration?"

George Eliot