

The Disruption of Subsistence Agricultural Systems in Rural Yucatan, Mexico May Have Contributed to the Coexistence of Stunting in Children with Adult Overweight and Obesity

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ABSTRACT

This paper attempts to link last century's disruption of local agricultural systems to today's presence of childhood under nutrition and adult overweight and obesity in the Yucatan Peninsula. It first compares Height for Age (H/A), Weight for Age (W/A) and Body Mass Index (BMI) of children from three rural populations in Yucatan and Campeche, Mexico whose subsistence strategy had been altered to different degrees since 1970. It then compares BMI in adults, in the same regions, born before and after the alteration of their environment in the 1970's. Children in the least disrupted zone were taller and had lower BMI than children in the other two, but were not heavier than children from the richest disrupted zone. Children in the poorest disrupted zone were shorter and lighter than the rest. BMI in adult men was higher in the two most disrupted zones only in those cohorts that grew up after the traditional agricultural regime was altered. It is concluded that disruptions of staple-based subsistence agriculture promoted a stockier phenotype in children and a tendency to accumulate body fat. Persistence of these conditions in the twenty first century has favored the coexistence of stunting during childhood with adults who easily become overweight.

Key words: growth, nutrition transition, double burden, Calakmul, agricultural change, Yucatan, anthropometric

Introduction

The association between childhood under nutrition and the alteration of staple-based subsistence agricultural regimes by globalizing forces was observed since the 1930's and confirmed throughout the twentieth century. The »dual burden of the nutrition transition« as Doak et al.¹ called the coexistence of under nutrition in children with overweight and obesity in adults of the same households has only recently been observed in rural populations, but it may be part of the same phenomena.

Since the 1970's it was observed, that the alteration of traditional subsistence strategies lead to childhood under nutrition because the money obtained from commercial crops, cattle or labor was enough to buy cheap low quality foods high in carbohydrates, but it seldom allowed local populations to buy adequate amounts of high quality foods to replace the essential nutrients (amino acids, vitamins, minerals, and fats) present in traditional diets.

These nutrient poor and calorie rich unbalanced diets will result in poor childhood growth, and they will also make adults gain weight. Frisancho² observed that children growing up in poor nutritional environments will be shorter, and develop permanent metabolic changes that will make them less efficient in the oxidation of body fat. These children will tend to accumulate fat and will become overweight easier than children growing under better conditions. In addition, stunted children will grow up to become shorter, heavier adults with less fat oxidation efficiency, a tendency to become overweight and to have greater serum triglyceride and serum leptin levels³. It is therefore possible that by generating stressful nutritional environments, the alteration of subsistence staple-based agricultural regimes may have promoted metabolic changes that today contribute to the unwelcome coexistence of stunting in children and overweight and obesity in adults.

This paper compares nutritional status and body composition in three agricultural populations from the Yucatan

Peninsula whose traditional staple-based regimes were altered to different degrees in the 1970's, to see if the alteration of their traditional staple-based agricultural regimes could have promoted the conditions that today have been identified as the double burden of the nutrition transition in rural areas. The economic success between populations also differed so that they could all be classified as being at three different stages of the Nutrition Transition⁴, The Famine stage, the Receding Famine stage, and the Degenerative Disease stage. This paper proposes that by unbalancing local diets the transition to the Receding Famine Stage (transition from dependence on food production to reliance on store foods and other global economy mechanisms) promoted a thrifty phenotype⁵ which leads to increased frequencies of stunted yet stockier children and overweight adults; preparing the road for a larger proportion of obese adults in the economically successful agricultural populations of the Degenerative Disease stage.

Background

In staple-based agricultural regimes the combination of crops, is such that protein, vitamin, and mineral deficiencies of each individual component are largely overcome by compensatory qualities of the other components. In addition, the diet depends on a large variety of non-cultivated plants and hunted animals that in combination with the staple provide necessary sources of vitamins and protein. In the Mexican tropics, agriculturalists depend upon a diversified subsistence strategy centered on the »milpa«; a diversified polyculture that includes maize (*Zea mays*), different types of beans (*Phaseolus sp.*), squash (*Cucurbita sp.*), chili peppers (*Capsicum sp.*) and other cultigens that will vary locally. The »milpa« is complimented by harvesting fallow fields, hunting and gathering, backyard agriculture and forest management. This traditional system has been altered to a different degree in each of the three research sites presented here affecting the diet of their populations (Figure 1).

The first population colonized the municipality of Calakmul, Campeche, Mexico during the 1970's and 1980's and will be referred to in this document as the population from the »Calakmul Region«. This municipality may be classified as belonging to the Famine stage. Colonists travelled to Mexico's southern tropical forests from different parts of Mexico to occupy lands allotted them as part of what turned out to be the countries' last agrarian reform. Thousands of acres of tropical forest became the last agricultural frontier. Today, households in Calakmul combine subsistence agriculture with jalapeño pepper (*Capsicum annum*) production for the market. Colonists in Calakmul do not have direct access to the market. All their production is sold to intermediaries that drive into the area to purchase their peppers. Intermediaries decide how much of the harvest they will buy, and set the prices. Urban labor markets are not easily accessible either. There is no circular migration, and those who migrate usually go to the US. In Calakmul, diet depends mostly on the traditional survival system. Agriculturalists har-

vest a diversified »milpa« and gather roots from abandoned fallows. Their backyards are at the same time a source of income and food, and their cuisine is heavily dependent on animals and vegetables hunted and gathered in the surrounding tropical forest⁶.

The second population is from the »Maize Region« in the state of Yucatan and fits the description of a population in the Receding Famine stage. This region was connected to the growing cities of Merida and Cancun in 1973 by a modern highway and an efficient public transportation system. Easy and rapid access to these cities allowed peasants to combine food production at home with salaried work in Merida and Cancun. Vaccination campaigns, available cash to pay for private medicine and medical attention, home and sanitary improvements reduced the disease load traditionally associated with pre-industrial agricultural populations⁷.

The third population was studied in the »Citrus Region« of the state of Yucatan, Mexico. In the 1940's a government sponsored water well drilling program transformed subsistence farmers into commercial agriculturalists who did not abandon food production. During the early 1970's local wealth increased and promoted the development of local services and industry. Farmers in the Citrus Region maintained control over the production and distribution of oranges and other citruses. They organized themselves to deliver the fruit to local and regional markets, and today they also export to the US. Next to the capital city of Merida the citrus region is the fastest growing area in the state⁸. Unlike the rest of the regions in this study, families have access to and can buy meat, and »party food« on a regular basis. This food is high in saturated and unsaturated fats and sugars so that they could be classified as belonging to the »Degenerative Stage« of the nutrition transition.

In the Maize and Citrus Regions population growth has forced agriculturalists to reduce fallow times and forest cover with disastrous consequences for the »milpa« system⁹. Peasants today must use herbicides which reduce the »milpa's« variability and there has been a reduction in the availability of wild plants and animals. In addition, since the 1980's the diet in these two regions has become ever more dependent on cheap carbohydrate rich store bought foods¹⁰. Unlike the population from the Citrus Region, the Maya from the Maize Region do not have enough money to buy meat, so that their cultivated maize is supplemented with cheap pastas, junk food, and sodas bought at the local stores.

Materials and Methods

This paper analyzes height and weight data obtained from four different research projects in the Citrus and Maize Regions of the State of Yucatan and in Calakmul, Campeche. Field work in the maize region was carried out between 1992 and 1996 in projects from CINVESTAV-Merida in Mexico. The data on the citrus region were collected in a 1998 project from Indiana University, and the Calak-

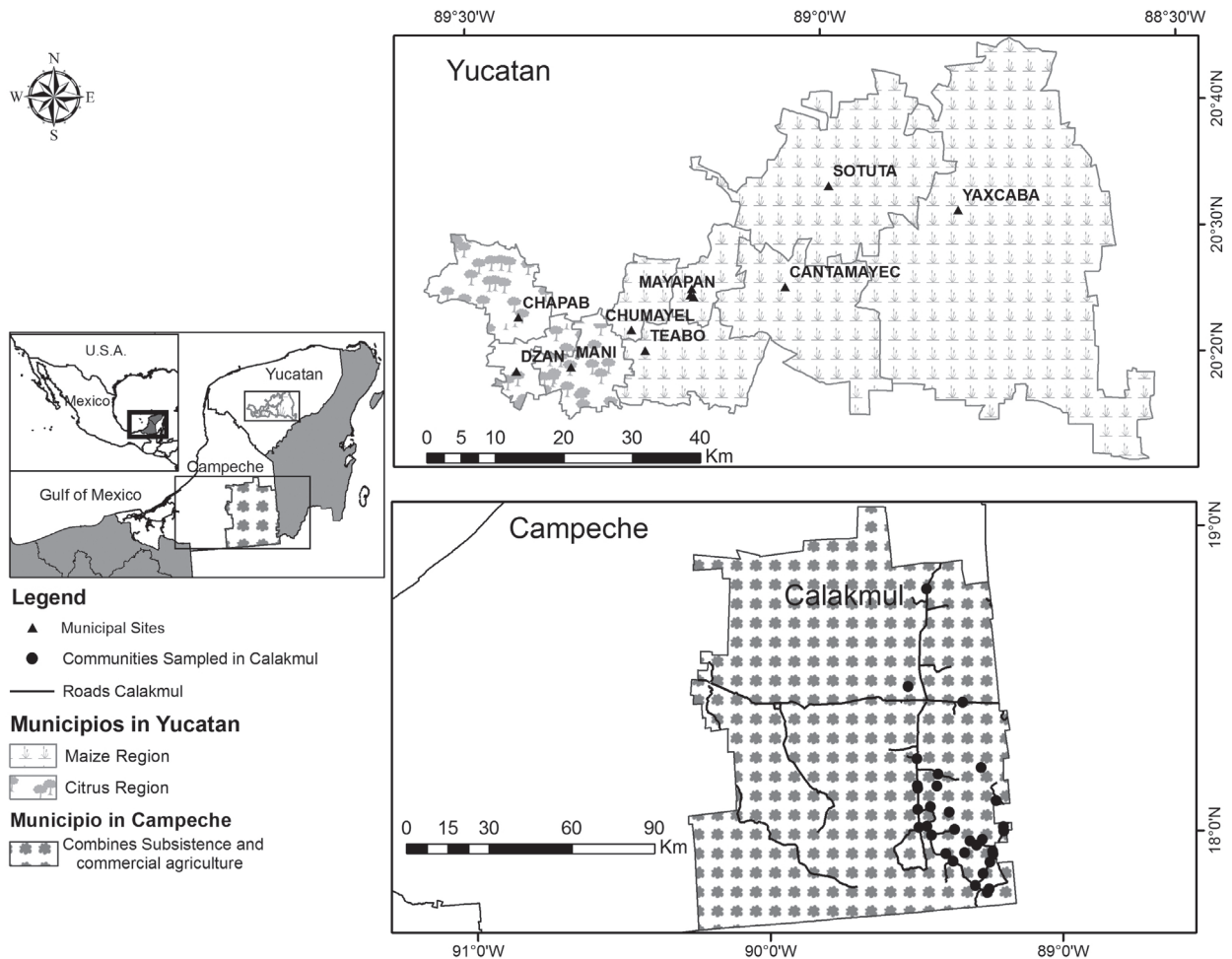


Fig. 1. Localization map of the three research sites. Communities tested in the Calakmul research site may belong to the municipality of Calakmul in Campeche or the municipality of Othon P. Blanco in Quintana Roo. The state boundaries are still under dispute (Maps modified from INEGI Marco Geoadministrativo Nacional 2000. Scale: Campeche: 1: 2 500 000; Yucatán: 1: 1 700 000). Map elaborated by Jazmin Avila-Barrientos.

mul project was based at ECOSUR, Campeche in 1999. In the state of Yucatan, a stratified sample by municipality was obtained to get a representative sample of the nutritional status of children under the age of 10 years in each region. In Calakmul, where the municipality boundaries are not clear, a statistical estimation method was used to obtain a representative estimate of childhood malnutrition in the most recently colonized communities. All adults present in the household at the time of our visit were also measured. Sampling strategy details may be obtained in Gurri et al.⁷ for the maize region, Balam et al.¹¹ for the Citrus Region and in Gurri et al.⁶ for Calakmul.

The projects originating at Indiana University were preapproved by IU's Human Subjects committee. CINVESTAV and ECOSUR, like most Mexican research institutions and universities at the time, did not have anything equivalent to a human subjects committee. As with the IU projects, however, the Mexican projects were pre-

sented to state, municipal, community and health authorities for review and authorization. The latter were the only ones in those days with a formal human subjects committee equivalent. The same procedures were followed in every project and in every case verbal informed consent was obtained from every household head who participated.

Individuals three years of age or older were measured using a Martin Type Anthropometer. They were weighed with as little clothing as possible, and without shoes, in a portable bath scale. Children under three years who could not stand straight were measured for length using an infant meter table and weighed with a spring scale for infants.

In each study, anthropometrists were standardized before going in to the field using the author as the »gold standard«. In each region tests were performed to control for interobserver error. No error measurements were made between studies. Since the author was the gold standard in each, measurement error could be attributable to un-

TABLE 1

NUMBER OF CHILDREN 10 YEARS OLD OR YOUNGER AND ADULTS 20 YEARS OR OLDER BY SEX AND RESEARCH SITE INCLUDED IN THIS STUDY

Research Site:	Years sampled:	Boys	Girls	Men	Women	Total
Citrus Region	1998	127	115	107	216	565
Maize Region	1992, 1996	431	422	247	437	1537
Calakmul	1999	435	399	496	473	1803
Total		993	936	850	1126	3905

conscious changes in the author's measurement technique. Measuring weight and height is relatively simple for an experienced anthropometrist, so little measurement error between groups should be expected. Nevertheless, the reader may want to keep this in mind when interpreting the significance levels of intergroup variance.

To test the hypothesis that children from the state of Yucatan were shorter and stockier; children from the three populations were compared using a one way ANOVA on the NCHS¹² z-score transformations of Height for Age (H/A), Weight for Age (W/A) and Body Mass Index (BMI). Whenever significant f values were obtained, Games-Howell post-hoc tests were run between populations. The Games-Howell test does not require equality of variances and adjusts degrees of freedom when sample sizes are unequal.

To test the hypothesis that only adults from Yucatan who grew up after their traditional subsistence base was altered experienced more overweight than adults in Calakmul, adult men and women were separated for analysis and grouped into two cohorts: those who grew up before their traditional subsistence strategy was altered, and those who grew up after that. BMI was estimated for men as W/H^2 and for women as $W/H^{1.5}$. A one way ANOVA was then run on each cohort divided by sex to compare differences between populations. Individuals between 10 and 20 years of age were excluded. Rapid growth, amongst other things, makes their mean and variances far too different from that of the other age groups. Finally the nutritional status of men and women 20 years old and older was estimated using WHO¹³ BMI cut-off points. In this case, the Quetelet Index was used for both men and women. Nutritional status differences between populations were compared after the populations were standardized by age using a χ^2 .

Results

Table I shows sample size per research site divided by sex for children and adults alike. Sample size required to obtain a significant estimate ($\alpha \leq 0.05$) of nutritional status for children under 10 years of age was smaller in the Citrus than in the Maize region. Only three municipalities were sampled in the former and five in the latter. In Calakmul, two municipalities were studied, but more households than those required by the original formula

were sampled. This was done in order to analyze regional variability in other household characteristics not necessarily related to nutritional status⁶. Thanks to the extra households, sample sizes in Calakmul and the Maize Region are similar except for the number of men measured. These are fewer in the state of Yucatan because the surveys were carried out at different times of the year and some households were visited during the seasons when they worked outside the area in the cities of Merida and Cancun. Men from Calakmul, on the other hand, remained in the area year round.

ANOVA test results and means for H/A, W/A and BMI per region are shown in Table II. Mean differences were significant for all three nutritional indicators. Games-Howell's post-hoc tests showed that Calakmul's children were significantly taller for their age than children from the Citrus Region, but were not significantly heavier. Children from both Calakmul and the Citrus Region were significantly taller and heavier than children from the Maize Region. The BMI of both Yucatec children was very similar and significantly greater than the BMI of Calakmul's children.

Table III shows the results of the one-way ANOVAs for men and women who grew up before and after their subsistence strategy had been altered. As expected from the hypothesis, significant differences between groups were found between adult males. Those from Calakmul had significantly lower BMIz scores than both Yucatec samples and citrus regions z scores were highest. No significant differences were found between males who grew up before their traditional survival strategy was altered. Results with women were not as clear. Although in both cohorts BMIz scores are lowest in Calakmul, intermediate in the Maize Region and highest in the Citrus Region, the differences are significant only in the older generation. Post-hoc tests differentiate women in Calakmul and those from the Citrus Region but those from the Maize region are not significantly different from any of the others.

BMI increases in the cohorts born after the alteration of their traditional survival strategy may be responsible for an increase in the frequency of individuals with overweight and obesity; particularly in the proportion of those who are obese. Table IV shows overweight and obesity frequencies according to the WHO¹³ classification for men and women 20 years of age and older in the three research sites. In all three sites women showed higher overweight

TABLE 2
NCHS (1977) Z SCORE TRANSFORMATION AVERAGES FOR H/A, W/A, AND BMI ONE WAY ANOVA AND GAMES-HOWELL POST HOC TESTS FOR CHILDREN UNDER AGE 10 OF BOTH SEXES IN THREE RESEARCH SITES

Research Site Averages:							
Indicator	Citrus Region ¹	Maiz Region ²	Calakmul ³	Total	f	df.	α
H/A z	-1.88 ^{2,3}	-2.27 ^{1,3}	-1.64 ^{1,2}	-1.95	65.12	2	<0.00001
S	(1.19)	(1.18)	(1.08)	(1.18)			
W/A z	-1.00 ²	-1.30 ^{1,3}	-1.01 ²	-1.14	19.61	2	<0.00001
S	(1.30)	(1.07)	(0.93)	(1.05)			
BMIz	0.21 ^{3*}	0.20 ³	.02 ^{1*,2}	0.12	7.76	2	<0.00001
S	(1.17)	(1.08)	(0.90)	(1.02)			
N	242	853	834	1929			

Superscripts indicate regions were post hoc tests show that means are significantly different ($\alpha < 0.02$) from the cell mean, and an * is added when $\alpha = 0.055$.

TABLE 3
ONE WAY ANOVAS AND POST HOC TESTS FOR BMI DIFFERENCES BETWEEN RESEARCH SITES IN INDIVIDUALS WHO GREW UP BEFORE AND BETWEEN THOSE WHO GREW UP AFTER THEIR SURVIVAL STRATEGY WAS ALTERED BY SEX

Research Site	Grew up after survival strategy alterations.				Grew up before survival strategy alterations.			
	N	BMIz	SD	Post hoc Tests*:	N	BMIz	SD	Post hoc Tests*
Calakmul ¹	310	-.326	.68	2,3	185	-.249	.89	
Maize Region ²	120	-.149	.81	1	127	-.066	.81	
Citrus Region ³	43	.005	.81	1	64	-.192	.80	
Total Men:	473	-.251	.74		376	-.177	.85	
ANOVA		f=5.5 <small>2df, α=0.005</small>				f=1.7, <small>2df, α=0.177</small>		
Calakmul ¹	317	.297	.78		147	.145	.89 ³	3
Maize Region ²	266	.355	.83		160	.285	.76	
Citrus Region ³	115	.424	.83		96	.419	.79 ¹	1
Total Women:	698	.340	.81		403	.266	.82	
ANOVA		f=1.1 <small>2df, α=0.329</small>				f=3.4 <small>2df, α=0.035</small>		

*Fisher’s least significant difference (LSD) post hoc tests. The numbers show populations significantly different from each other.

and obesity frequencies than men, and a greater proportion of women classified as overweight were obese. Men and women from both Yucatec populations had significantly greater frequencies of overweight individuals than Calakmul ($\chi^2=32.49$; 6d.f; $\alpha < 0.001$ for men and $\chi^2=45.26$; 6d.f.: $\alpha < 0.001$ for women). Overweight frequencies were similar between the Citrus and the Maize regions in both men and women. The proportion of those overweight who were obese in the Citrus region, however, was considerably greater in both men and women.

Discussion

There are ethnic differences between the populations from the state of Yucatan and the population from Calak-

mul. The former is mostly Yucatec Maya and the latter includes other Maya groups and Mexican admixed individuals who came from different parts of the country. In addition, while the older pre-globalization cohorts in the state of Yucatan lived there, those in Calakmul came from different places and were therefore exposed to different and unknown environmental conditions. Both adiposity and height have a genetic and environmental component¹⁴ but to the knowledge of the author no one has shown BMI population differences to be genetically determined. In this case, genetic differences in growth and BMI between populations are unlikely. To the knowledge of the author, no one has yet shown that the Yucatec Maya are genetically shorter than other Maya or other Mexican Admixed groups. If anything, studies with well fed first generation Maya populations in the US have shown that they can be

TABLE 4
WHO (1995) BMI NUTRITIONAL CLASSIFICATION FOR MEN AND WOMEN 20 YEARS AND OLDER PER RESEARCH SITE. PERCENT-AGES WERE STANDARDIZED BY AGE*

	Classification	Research Site:		
		Citrus Region	Maiz Region	Calakmul
Men	Underweight.	1.9%	1.8%	2.9%
	Normal	55.9%	52.7%	62.3%
	Pre-Obese	31.1%	36.8%	28.9%
	Obese	11.1%	8.6%	5.9%
	Total Overweight	42.2%	45.4%	34.8%
	N	107	247	496
$\chi^2=32.49; 6_{df}; \alpha < 0.001$				
Women	Underweight.	1.8%	2.6%	2.5%
	Normal	33.6%	36.2%	43.5%
	Pre-Obese	36.0%	40.6%	33.3%
	Obese	28.5%	20.7%	20.7%
	Total Overweight	64.6%	61.3%	54.1%
	N	216	437	473
$\chi^2=45.26; 6_{df}; \alpha < 0.001$				

* The population pyramid of all three samples was used to standardize by age cohort.

taller than other Latin American populations regardless of ethnic origin¹⁵. Finally, while ethnic differences may be responsible for some BMI variation between Black, White, Asian and Hispanic populations, none have been found between Amerindian populations and those classified as Hispanic, to which the Mexican Admixed people from Calakmul could belong to.

Finally, the reader should keep in mind that individuals from the Maize region were measured between six and two years before those from the Citrus Region and the latter a year before those from Calakmul. Cohort comparisons do not necessarily include individuals born within the same five year period. Nevertheless, all individuals 35 years old or younger sampled in the state of Yucatan had reached the age of 10 years after their traditional subsistence strategy had been altered. All individuals who were 35 or older when measured were older than ten years of age when their staple base regimes were altered. Most individuals from Calakmul younger than 40 years grew up in Calakmul depending mostly on food production, while those older than 40 grew up somewhere else. Their ecological conditions were heterogeneous making differences between groups in individuals 40 years or older difficult to interpret.

Most evolutionary models addressing today's obesity epidemic assume that commercialization has added new food sources to a diet based mostly on starches. Popkin's⁴ nutrition transition hypothesis, proposes that store foods not only add refined carbohydrates to the diet of subsistence farmers, but that they also reduce the population's

risk of running out of food during catastrophic events such as drought or hurricanes. Unlike expectations, childhood chronic under nutrition as evidenced by lower H/A and W/A values in this sample, was greater in the Maize and Citrus regions than in Calakmul where people depend mostly on locally produced food. These results are in agreement, however, with most of the twentieth century case studies which suggest that store foods are unable to make-up for the diversity and complementarities of the disturbed traditional staple based diets. Today in the Maize Region, as much as 20% of a child's caloric needs come from sugar-sweetened sodas and store bought pastas and other flour products¹⁰. Finally, although the caloric intake seems adequate amongst the Maize region children, their diet lacks important micronutrients and animal protein^{7,10}. It would appear therefore that the introduction of cheap industrial foods in altered staple-base agricultural regimes does not simply add new sources of energy, but it actually substitutes nutritious for less nutritious food leading to early childhood malnutrition in spite of adequate or excessive caloric intake.

Children from the more economically successful Citrus region have access to animal protein and could be categorized in the Degenerative Disease pattern. As would be expected from nutrition transition theory they are taller and heavier than those from the Maize region. Unlike expectations, however, Citrus region children are shorter for their age than children from Calakmul suggesting greater chronic under nutrition. According to Wells¹⁴ children exposed to a stressful nutritional environment in

utero and during the first two years of life when linear growth is canalized will develop a thrifty phenotype. The latter is associated among other things with greater central fat deposition and a lower efficiency in the oxidation of body fat². Wells¹⁴ argues that a thrifty phenotype could promote the accumulation of body fat in infants to fund later accretion of lean mass in populations where dietary intake may be insufficient or perturbed. This mechanism in populations like those from the Maize and Citrus regions may lead to early adiposity tracking on into childhood. The data presented here do not tell us anything about the distribution of body fat. In addition, although Calakmul's diet is richer and more variable than that of the other two regions, the nutritional content of these diets has not been statistically compared. Nevertheless, the fact that Citrus Region children have similar W/Az scores than their taller counterparts from Calakmul, and that BMIz scores in children from both Maize and Citrus regions are greater than in Calakmul's children does suggest that a greater metabolic load in the Maize and Citrus regions may be developing from a very young age.

A thrifty phenotype in adults may lead to several health risks such as Type II Diabetes Mellitus, high blood pressure, heart disease and hyperlipidemias, and because these are associated to high BMIs the latter could serve as an indirect proxy of thrift. An imperfect proxy since BMI could reflect later peripheral fat deposition or over developed upper body muscle mass not associated with early life experience. In these samples BMI differences would support the existence of thrifty phenotypes in the Maize and Citrus Regions, only if the cohorts who grew up after the alteration of their traditional environment behaved differently from those who grew up before.

In the Yucatan Peninsula, the ecological transformations affecting childhood malnutrition started with the alteration of their traditional survival system in the 1970's. We should, therefore, expect to find greater BMIs in adults who grew up after this date in both Maize and Citrus Regions. This prediction held up for BMI comparisons between males. Adult males 25 to 35 years old from the state of Yucatan have greater BMIs than those in the same age cohorts from Calakmul while the older males have similar BMIs in all three research sites. Unlike expectations, however, significant differences between groups in women were found in the older women who grew up when the nutritional environments were similar between groups. In both generations these BMIz scores follow the order expected from nutrition transition theory suggesting that adult women's phenotype reflects their present nutritional environment which appears to be significantly more obesogenic in women than it is in men.

According to their nutritional classification little more than half of the men in the Maize and Citrus regions were classified as normal, and as many as 62.3% of the men were normal in Calakmul. Less than half of the women in all three areas, however, were classified as normal and in the Citrus region as many as 64.6% were classified as overweight. Food intake, however, did not vary between men and women in any of the three research sites. What

did vary by gender was type of activity. Men's activities in all three regions were energetically expensive and carried out under the sun. In the case of Yucatec men, this occurred whether the activity was carried out in their local fields or during the seasons of migratory work as construction workers in the cities. It should be noted here that practically every man 35 years old or younger measured, worked in Merida and Cancun during the seasons with little demand for agricultural work. There should not be any differences, therefore, between them and those who could not be measured because their households were visited during these seasons.

Most women's activities, on the other hand, were indoors, required less movement and less energy expenditure. Under these circumstances, it is difficult to make a case for early life influences on metabolism between women. Nutritional status differences between sites likely reflect the impact that the alteration of their staple base regime has had in each of their adult diets. Because their diet is based on maize, even women from Calakmul, could be expected to develop high BMIs due to fat deposition as they become adults and take on household responsibilities. A reduction in the staple based regimes associated food availability has brought an increase in a store-food diet, rich in carbohydrates in the Maize region. Although no cohort differences may be seen between Maize region women and Calakmul, a greater percentage of the former were classified as overweight. Finally, unlike women from the Maize region and Calakmul, women in the Citrus region have a diet that is rich in animal fat, and is similar to that of other Yucatec urban and semi-urban populations. Consequently, their overweight and obesity frequencies are similar.

In these Yucatec populations, the coexistence of childhood under nutrition and adult overweight and obesity by the end of the twentieth century is likely the result of a process that started in the 1970's when the alteration of staple-base subsistence agriculture affected the essential nutrient complementarities of the traditional diet. In doing so, it probably promoted metabolic changes affecting fat deposition in children making them more susceptible to accumulate body fat and become overweight adults. This process has not been reversed and children continue to be undernourished. Today, however, these communities have increasing access to fat, cholesterol, sugar, and other refined carbohydrates in their diet which increases the number of overweight adults. The deliberate disruption of subsistence staple-base agricultural regimes was a universal policy during the second half of the twentieth century and childhood malnutrition continues to be wide spread. If, as it happened in our sample, these populations get access to secure sources of carbohydrates, the double burden of the nutrition transition may easily become a global rural phenomenon.

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POREMEĆAJI POLJOPRIVREDNIH SUSTAVA U RURALNOM YUCATANU SU DOPRINIJELI SMANJENOM RASTU DJECE I PRETILOSTI KOD ODRASLIH

SAŽETAK

U radu se pokušava povezati gašenja lokalnih poljoprivrednih sustava u prošlom stoljeću s današnjom prisutnosti podhranjenosti djece i povećane težine i pretilosti kod odraslih na poluotoku Yucatan. Prvo uspoređuje visinu kroz dob (H/A), težinu s dob (W/A) i indeks tjelesne mase (BMI) kod djece iz tri ruralne populacije u Yucatanu i Campecheu u Meksiku čija je strategija opstanka bila promijenjena u različitim stupnjevima od 1970. Zatim uspoređuje BMI kod odraslih, u istim regijama, rođenih prije i nakon promjene njihovog okruženja u 1970-ima. Djeca u najmanje poremećenim zonama su jača i imaju niži BMI od djece u druge dvije, ali nisu bila teža od djece iz najbogatije poremećene zone. Djeca u najsiromašnijoj poremećenoj zoni su niža i lakša od ostalih. BMI je kod odraslih muškaraca bio veći u dvije najviše poremećene zone samo u onim skupinama koje su izrasle nakon što je izmjenjen tradicionalni poljoprivredni režim. Zaključeno je da su poremećaji u sustavu izvozne poljoprivrede promovirali zdepastiji fenotip kod djece i tendenciju akumulacije tjelesne masnoće. Postojanost ovih uvjeta u dvadeset prvom stoljeću je pogodovalo suživot smanjenog rasta djece s odraslima koji lako postaju pretili.