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ORIGINAL

Prevalence and perspectives of food insecurity among university students from indigenous communities in northwest Mexico

Prevalencia y perspectivas de la inseguridad alimentaria en estudiantes universitarios de comunidades indígenas del noroeste de México

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ABSTRACT

Introduction: food insecurity is a global public health issue for Indigenous students.
Objectives: To characterize the prevalence of food insecurity and explore the perspective about food insecurity of students from indigenous communities attending universities in northwest Mexico.
Method: this study used a mixed-methods approach. Quantitative data was gathered from an online survey to assess the prevalence of food insecurity, socio-economic, dietary, sleep quality, stress, and academic performance status of 328 university students from indigenous communities. Also, weight and height measurements were recorded. The 328 survey respondents provided the recruitment pool for the qualitative data collection. This data was obtained via three focus groups and open-ended questions to explore perspectives on food insecurity. Multiple lineal regression and constant comparison methods were used for data analysis.
Results: food insecurity was found in 83,5 % of students. Variables associated with increased food insecurity ($p<0,05$) include: living alone (β=1,971) with peers (β=0,936), timeframe of undergraduate program (β=0,523), nutritional behaviors (β=-0,260), higher stress levels (β=0,669), poor sleep quality (β=0,328), poor academic performance (β=-0,037).
Students experienced food insecurity and hunger throughout their time as university students. Strategies to cope their food insecurity included reducing food portions and variety, as well as selling personal cultural items.
Conclusion: indigenous students attending universities in northwest Mexico exhibits high levels of food insecurity. Students' perspectives on food insecurity are interconnected with demographic, academic, psychological, health, and nutritional behaviors. These findings should be considered when designing and implementing programs to prevent and address food insecurity and hunger among students from indigenous communities.

Keywords: University Students; Food Insecurity; Indigenous Groups, Academic Performance, Hunger.

RESUMEN

Introducción: la inseguridad alimentaria es un problema de salud pública mundial que afecta a los estudiantes indígenas.
Objetivos: caracterizar la prevalencia de inseguridad alimentaria y explorar las perspectivas sobre inseguridad alimentaria de estudiantes de comunidades indígenas que asisten a universidades del noroeste de México.
Método: estudio con enfoque de métodos mixtos. Se recopilaron datos de 328 estudiantes mediante una encuesta en línea para evaluar inseguridad alimentaria, datos socioeconómicos, dieta, calidad del sueño, estrés y rendimiento académico. También se registraron peso y talla. Para conocer las perspectivas de inseguridad alimentaria se realizaron tres grupos focales que incluyeron preguntas abiertas. El análisis se llevó a cabo mediante métodos de regresión lineal múltiple y comparación constante.
Resultados: el 83,5 % de los estudiantes presentó inseguridad alimentaria. Las variables asociadas con mayor inseguridad alimentaria ($p<0,05$) fueron: vivir solo (ß=1,971) o con compañeros (ß=0,936), duración del programa (ß=0,523), hábitos nutricionales (ß=-0,260), estrés elevado (ß=0,669), mala calidad del sueño (ß=0,328) y bajo rendimiento académico (ß=-0,037).
Los estudiantes reportaron haber experimentado inseguridad alimentaria y hambre durante su etapa universitaria. Entre las estrategias para afrontarla destacaron reducir raciones y variedad de alimentos, así como vender pertenencias culturales.
Conclusión: los estudiantes indígenas de universidades del noroeste de México presentan altos niveles de inseguridad alimentaria. Las perspectivas sobre inseguridad alimentaria están interrelacionadas con factores demográficos, académicos, psicológicos, de salud y hábitos alimenticios. Estos resultados deben considerarse en el diseño y aplicación de programas dirigidos a prevenir y mitigar la inseguridad alimentaria y el hambre en estudiantes de comunidades indígenas.

Palabras clave: Estudiantes Universitarios; Inseguridad Alimentaria; Grupos Indígenas; Rendimiento Académico; Hambre.

INTRODUCTION

Food insecurity is defined as limited or uncertain access to nutritionally adequate food or limited ability to obtain safe food in a socially acceptable manner.[1,2] Despite global advancements in technology, artificial intelligence, and infrastructure, the effects of the pandemic have exacerbated food insecurity, particularly in developing and intermediate-development countries, such as Mexico.[3] Mexico is currently facing an economic recession, a lack of access to nutritious food, inaccessible nutritious food, and unhealthy food environments.[4,5] The consequences of food insecurity are severe for all population sectors, hindering the development of skills and health and nutrition for university students.[6]

Additionally, most students undergo a transition from living at home to beginning an independent adult life during their undergraduate studies.[7] Simultaneously, they face the challenge of taking full responsibility for their dietary choices for the first time. In this context, it has been reported that university students tend to develop unfavorable eating habits, showing a significant shift toward behaviors that may compromise their health and food security.[8]

Nearly two decades after the first report on food insecurity among university students, researchers around the world have documented its increasing prevalence.[9] The prevalence of food insecurity among university students during the 2020 pandemic was 42 %, and up to 75 % among international students.[10] University students report some degrees of food insecurity, with particularly high percentages among Latino students: 63 % of Latinos from single-parent families experiencing this situation during their time at university.[11] In Mexico, 48 % of university students in the eastern region faced difficulties related to food insecurity, situation that rises to 84 % for indigenous students in the southwestern region.[12,13]

In Mexico, 11,5 % of the population between the ages of 18 and 25 identifies as indigenous or as part of an ethnic group.[14] This population continues to grow and migrate from rural to urban areas to attend university. The challenges of attending university, combined with social, economic, cultural, and educational barriers, can affect food security, health, and academic performance.[15,16] Over the past decade, an increasing number of students from indigenous communities have migrated from their hometowns to pursue a college degree.[9] Studies by Wilson et al.[17] and Innis et al.[18] have shown that this change of residence negatively impacts them, particularly with regard to health, nutrition, and food security.

Although universities have historically offered programs to provide food access for minority groups, such as students from indigenous communities, there is insufficient scientific evidence regarding the perspectives of students affected by food insecurity.[19] This includes information on the variety and types of food these students

have access to, the difficulties they face in accessing fresh and nutritious food away from their communities, and the prevalence of this issue.

Here we aimed to characterize the prevalence of food insecurity and explore the perspective about food insecurity of students from indigenous communities attending universities in northwest Mexico. This will facilitate a more comprehensive understanding of the food insecurity experienced by this population and the prevalence of the issue.

METHOD

Type of study

This is a cross-sectional nonprobability survey of 328 students from Indigenous communities attending universities in northwest, Mexico. The study employs a mixed-methods approach, integrating both qualitative and quantitative analyses

Universe and sample

This research constitutes a segment of a project initiated in August 2020, aimed at identifying the associate factors of food insecurity among students in Northwest Mexico. The sample size estimated for the original project was 1,864 students.[20,21] From the original project's participant pool, a total of 328 students from Indigenous communities voluntarily completed online surveys for this study. Participants were recruited across diverse academic disciplines from selected universities including: humanities and fine arts; economic and administrative sciences; social sciences; engineering; exact and natural sciences; and biological and health sciences.

Collection of Quantitative Data

Food Security

Food security was evaluated using the Food Insecurity Experience Scale (FIES) The scale individually assesses the change in the quantity and quality of food over the past 12 months through 8 items that allow food insecurity to be categorized into three levels based on the total score: mild food insecurity (1 to 3), moderate food insecurity (4 to 6) and severe food insecurity (7 to 8).[22]

Nutritional Knowledge and Behaviors

Students' nutritional knowledge and behaviors were assessed using an adaptation of the FAO Guidelines for Assessing Nutrition-Related Knowledge, Attitudes, and Practices. The instrument is divided into two dimensions: (1) knowledge and (2) behaviors, and includes 29 questions that cover 13 common nutrition topics. To obtain a total score, responses are classified as either adequate or inadequate. A higher score indicates that the category is adequate.[23]

Perceived Stress

The Perceived Stress Scale was used to assess the degree to which life situations are perceived as stressful.[24] The scale consists of 14 questions, each with five response options ranging from "never" to "very often." The total score ranges from 0 to 56, with higher scores indicating higher levels of stress. The stress score was classified as follows: no perceived stress (< 19), mild perceived stress (19 to 28), moderate perceived stress (29 to 38), and severe perceived stress (39 to 56).[25]

Sleep Quality

The Pittsburgh Sleep Quality Index (PSQI) was used to measure sleep quality and sleep disturbance over the past month. The PSQI is a 19-item, self-administered questionnaire. The sum of the items results in a total score ranging from 0 to 21, with a higher score indicating poor sleep quality. In addition, poor sleep quality was divided into low and high levels based on the average score.[26]

Sociodemographic and Nutritional Status

The social, demographic, economic and academic data of the students were obtained using a 22-item survey. Weight and height data were self-report for all students; however, a sub-sample of 40 % of the students were selected to have their weight and height measured by trained personnel to validate the self-reports with direct measurements. The World Health Organization (WHO) cut-offs for body mass index (BMI) were used to classify nutritional status.[27]

Academic score

Academic performance was evaluated using students' official institutional records (Kardex), with a particular focus on self-reported grade point averages (GPA). Following the Mexican higher education grading system,

academic achievement was measured on a 0-100 scale, where scores of 60 or higher represent passing grades.

Collection of Qualitative Data

To understand the perspectives of food insecurity and hunger among indigenous students, interviews were conducted using the focus group technique. This qualitative research technique consists of discussing a topic of interest with a group of people using a script of topics as a method of generating information that allows the perspective of the people interviewed to be identified.[28] To support the focus group interviews, a script was used consisting of questions that addressed information related to the perspective of food insecurity.[29]

Ethical standars

Written informed consent was obtained from all participants and the study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the University of Sonora, Mexico (CEI-UNISON 06/2021). The students did not receive any kind of incentive to take part in the study.

Analysis of Data

Quantitative analysis of the variables was performed using descriptive statistics. For the exploratory analysis, means and standard deviations were calculated for continuous variables and frequencies and percentages for categorical variables.

The potential association of student characteristics with food insecurity was analyzed using simple linear regression models ($p<0,2$). Multiple linear regression models were then run to determine the variables associated with food insecurity using forward stepwise regression ($p<0,05$). Coefficients (ß) and 95 % confidence intervals (CI) were estimated. Statistical significance was considered when $p<0,05$.

Moreover, food insecurity was considered an independent variable for stress scores, poor sleep quality scores, and academic performance. Therefore, multiple linear regression models were constructed for each dependent variable using a combination of simple linear regression ($p < 0,2$) and forward stepwise regression ($p < 0,05$).

The interaction ($p < 0,1$) and multicollinearity (VIF < 10) of all preliminary models were assessed. Regression assumptions were verified using residual plots. All analyses were conducted using SPSS version 27

For the qualitative analysis, the focus groups were audio-recorded with the prior consent of the participants. The recordings were then fully transcribed to preserve the participants' original narratives. The data were organized into themes and sub-themes using the constant comparison method, which involves collecting and grouping information from the focus groups into categories and systematically analyzing it.[30,31]

RESULTS

Of the total sample of 328 students, 98,2 % (n = 322) completed all sections of the surveys. Food insecurity was prevalent in 83,5 % (n = 274) of the participating students, of whom: 26,5 % (n = 87) were classified as mild, 31,1 % (n = 102) as moderate, and 25,9 % (n = 85) as severe, respectively. The general characteristics of university students from indigenous communities are shown in table 1.

Table 1. General characteristics of university students from indigenous communities in northwest Mexico (n=328).

Characteristics	Mean ± DE o % (n)[a]
Sociodemographic	
Age, years	21,3 ± 3,5
Sex	
Male	39,0 (128)
Female	61,0 (200)
Marital status	
Single	89,0 (292)
Married	5,8 (19)
Living in a common law marriage	5,2 (17)
Parental status	
No children	86,9 (285)
With children	13,1 (43)

Employment	
No	74,4 (244)
Yes	25,6 (84)
Current company at home	
Family	69,8 (229)
Friends or classmates	11,6 (38)
Student's house	4,0 (13)
Partner	5,5 (18)
Alone	8,5 (28)
Indigenous group	
Mayos	71,0 (233)
Yaquis	5,5 (18)
Series	2,4 (8)
Papagos	5,5 (18)
Zapotecos	2,4 (8)
Mixtecos	4,0 (13)
Other groups*	9,1 (30)
Academic	
Discipline enrolled	
Humanities and Fine Arts	0,6 (2)
Economic and Administrative Sciences	20,4 (67)
Social Sciences	28,7 (94)
Engineering	8,8 (29)
Exact and Natural Sciences	10,4 (34)
Biological and Health Sciences	31,1 (102)
Timeframe of undergraduate program	8,4 ± 0,6
Academic performance, average	8,9 ± 0,9
Economic	
Financing your studies	
Family	66,5 (218)
Employment	16,2 (53)
Scholarship	16,5 (54)
Loan or credit	0,9 (3)

Note: [a]Values expressed as mean and standard deviation (±) or percentage (%) and number (n), *Other groups: Chatinos, Chinantecos, Tarahumaras, Tepehuanes, Triquis, Tzotzil and Wixarika.

Table 2. General characteristics of university students from indigenous communities in northwest Mexico (n=328).

Characteristics	**Mean ± DE o % (n)[a]**
Food scholarship	
No	88,1 (289)
Yes	11,9 (39)
Nutritional	
Nutritional knowledge	10,6 ± 2,1
Adequate	54,9 (180)
Inadequate	45,1 (148)
Nutritional behaviors	6,4 ± 2,0

Adequate	49,7 (163)
Inadequate	50,3 (165)
Psychological	
Stress	26,4 ± 7,4
No stress	13,1 (43)
Low stress	50,6 (166)
Moderate stress	30,5 (100)
Severe stress	5,8 (19)
Health	
Poor quality of sleep	6,7 ± 3,2
Low level	65,5 (215)
High level	34,5 (113)

Note: [a]Values expressed as mean and standard deviation (±) or percentage (%) and number (n).

The Seris student group had the highest average stress score (33,2), poor sleep quality (9,7), and the lowest average nutritional knowledge (9,1) compared to the other groups. In contrast, the Zapotec student group had the lowest average body mass index (BMI) (23,2 kg/m^2), stress score (23,7), and the highest average of adequate nutritional behaviors (6,88).

Variables Associated to Food Insecurity

The variables associated with an increase in food insecurity were living with friends or colleagues (ß=0,936, p=0,042) or alone (ß=1,971, p<0,001), increasing the timeframe of undergraduate program (ß=0,523, p=0,037), and inadequate nutritional behaviors (ß=-0,260, p<0,001) (table 3).

Table 3. Multiple linear regression model of variables associated with food insecurity in students attending public universities in northwest Mexico (*n*=328).

	Food insecurity, score*	
Independent variables	**β - Coefficient (CI 95 %)**	***p***
Current company in the home Family (reference)	-	-
Friends or classmates	0,936 (0,035, 1,836)	0,042
Student's house	1,008 (-0,455, 2,471)	0,176
Partner	0,020 (-1,239, 1,279)	0,975
Alone	1,971 (0,945, 2,997)	<0,001
Timeframe of undergraduate program	0,523 (0,032, 1,013)	0,037
Nutritional behaviors (score)	-0,260 (-0,403, -0,117)	<0,001

Note: CI = confidence interval, *Food insecurity score provided on a scale of 0–8, with higher scores indicating greater food insecurity

Variables Associated with Negative Outcomes of Food Insecurity

According to multiple linear regression models, as food insecurity increased we found increasing stress levels (ß=0,669, p<0,001), as well as poor sleep quality (ß=0,328, p<0,001).

In contrast, increased food insecurity was associated with a decline in school performance (ß=-0,037, p=0,023) (table 4).

Three focus groups were conducted, with an average of 6 ± 1 students from eight Indigenous communities participating. Eight themes related to food insecurity and hunger emerged (table 5). Textual quotes from participants, organized by theme, are included below.

Table 4. Multiple linear regression models of health and academic outcomes of food insecurity in students attending public universities in northwest Mexico.

Dependent variables	n	β - Coefficient (CI 95 %)	*p*
Stress, score[a]	327	0,669 (0,389, 0,949)	<0,001
Poor sleep quality, score[b]	327	0,328 (0,204, 0,452)	<0,001
Academic performance, average[c]	321	−0,037 (−0,069, −0,005)	0,023

Note: CI = confidence interval, [a]Adjusted for age and sex. On a scale of 0–56, where a higher score indicates a higher level of stress, [b]Adjusted for sex and university financing. On a scale of 0 to 21, where a higher score indicates an increasing level of poor sleep quality, [c]Adjusted by sex, region, hours of study per week and timeframe of undergraduate program.

Table 5. Categorization of the emerging themes obtained from the focus groups.

Emerging Theme	Definition	Mentions[a]
Perspectives on Food Insecurity	Participants described it as a shortage of food due to a lack of economic resources. This scarcity results in physical, psychological, and nutritional difficulties.	19
Experiences with Food Insecurity	Statements of experiences that students identify as food insecurity	44
Food Insecurity Due to Change of Residence to Study	Statements identifying changes in food consumption and food insecurity when moving from a rural community to the city for university.	45
Poor food handling and sanitation practices at the university	Statements identifying perceived risks associated with consuming food available at the university due to inadequate hygienic handling during preparation.	3
Factors Contributing to Food Insecurity During University	Economic factors are the main contributors to food insecurity and hunger among university students.	28
Effects of Food Insecurity Among Students During Their University Studies	The effects of food insecurity on the physical and mental health of university students.	91
Coping Strategies for Food Insecurity	Statements about common strategies for achieving daily meals.	39
Proposals to Reduce Food Insecurity at the University	Having balanced and economical meals.	36

Note: [a]Number of mentions made by students of the emerging topic.

The following quotes exemplify the themes that emerged during the focus group interviews.

Perspectives of Food Insecurity

"It's that feeling in the stomach that kind of hurts. It bothers me because it makes noise, the weakness it causes, and the bad mood. I think all of that is hunger" (Male, 23 years old, Tzotzil).

Experiences of Food Insecurity

"I feel uncomfortable, and I can't concentrate much when I'm hungry (academic performance). I always think about food, and I think that's why I get hungrier" (Female, 24 years old, Seri).

Food Insecurity Due to Change of Residence for Studies

"The situation was that when I arrived here in Hermosillo, well, back in my town I ate more or less fruits and vegetables, but here where I'm living, the store is very far away. The store I have nearby doesn't have much variety of fruits and vegetables" (Male, 23 years old, Seri).

"I wasn't used to eating sandwiches, hamburgers, and pizzas" (Male, 20 years old, Mixteco).

Poor Food Handling and Sanitation Practices at the University

"You get scared of eating at the little stores here; I once got salmonella" (Female, 18 years old, Seri).

Factors Contributing to Food Insecurity During University

"There are times when I don't eat all day when I'm in the city because I use the money I have to buy school supplies or cover other expenses. I'd rather not eat than spend the money" (Female, 20 years old, Yaqui).

Outcomes of Food Insecurity During University

"Hunger puts me in a bad mood and irritates me" (Female, 19 years old, Seri). "I can't concentrate much when I'm hungry" (Female, 24 years old, Seri).

Coping Strategies for Food Insecurity

"Buy food that lasts, like rice" (Female, 21 years old, Huasteco).

"So, it's like I'm going to eat until 4 o'clock so I don't have dinner. It's not at lunch or dinner time, it's a middle ground" (Male, 20 years old, Mixtec).

Proposals to Reduce Food Insecurity

"They could implement some kind of meal plan, something where you could combine different ingredients to make a meal. It could be cheap, and if you combine these items, you'd already have a complete meal". *(Male, 20 years old, Mixteco).*

DISCUSSION

This study aimed to determine the prevalence of food insecurity and explore the perspective about food insecurity of students from indigenous communities attending universities in northwest Mexico. In this proyect, high level of food insecurity, was found, which closely aligns with the findings from a study conducted among university students in an indigenous community in southern Mexico (84,3 %).[13] Our results highlight the need for strategic interventions targeted to university students in general who have reduced the quality and quantity of their food in the past year, skipped meals or gone without food for a whole day due to lack of resources, especially for those of indigenous origin.

In this context, students from indigenous communities are at higher risk of food insecurity than non-indigenous counterparts. One of the factors associated with increased food insecurity of indigenous students was living away from the family nucleus due to their academic persuit. They face food insecurity because is the first time they have to cover the costs of rent, tuition, school supplies, personal expenses, food, and move from their rural communities. As a result, and given the lack of experience in financial organization, students choose to set aside food as their first resource to meet other needs. This is consistent with the findings of Micevski et al.[6] where 53 % of students living with their parents were less likely to experience food insecurity than their counterparts living away from home and even receiving government assistance.

On the other hand, it was found that for each increase in the nutritional behavior score related to appropriate behaviors, the risk of food insecurity decreased. These findings are consistent with El Zein et al.[32] where poor eating habits were associated with a higher risk of food insecurity among university students in the United States. It has been reported that the lack of appropriate nutritional behaviors among food-insecure populations may be due to personal choices, lack of knowledge, or lack of skills to prepare food; therefore, interventions aimed at improving knowledge, skills, and attitudes related to food may improve nutritional behaviors among food-insecure students.[33]

Here we found negative outcomes of food insecurity among participants, the Seris student group had the highest average stress, poor sleep quality, and lowest average nutritional knowledge, as well as the highest prevalence of food insecurity. While the Zapotecos student group had the lowest average of body mass index and stress, they had the highest average of nutritional behaviors and the lowest prevalence of food insecurity.

The Seris have several factors that predispose them to food insecurity. First, they have a long history of struggle for their rights, having suffered decades of exclusion that have led to their near disappearance. Second, most of their caloric intake comes from just 10 foods, and half of that intake comes from sugary drinks, which has led to several health problems in this group, including obesity. Finally, due to the territory where they live is primarily maritime, the main source of exploitation of their resources continues to be fishing so as it is the only primary activity, they have access to, they may face scarcity.[34,35,36]

On the other hand, the Zapotecos are located in an industrialized region. They benefit from salt production and fishing, and their territory is suitable for agriculture. They have also diversified their sources of income. Additionally, there is solidarity within the community, expressed through cooperation and economic support.[37]

One of the advantages of our study is the implementation of a mixed-methods design that included focus groups. This was driven by the need for research their perspective about food insecurity and hunger.[38]

During the process of interviews the factors associated with food insecurity reported through the quantitative methodology were corroborated, including the risk of living without a family and inadequate nutritional behavior. In addition, the student's quotes confirmed the negative consequences of food insecurity, such as stress, poor sleep quality, and lower academic performance, which together may lead to a decrease in the academic achievement of indigenous students.

It was possible to identify that among the challenges that students face as a result of moving are the food deserts and swamps that are growing in urban areas.[39] Interviews confirmed that students have difficulty

obtaining a variety of foods at the university, where only ultra-processed or high-energy foods are available. Similarly, they face the challenge of not being able to find fresh food in the area where they live, having to travel long distances to buy food, or not being able to buy food because of the hours of operation of businesses. Therefore, it highlights the need to develop public and community actions focused on increasing the availability of healthy foods in close proximity and within university educational institutions to reduce health risks.

One of the limitations of our study was the inability to conduct a completely random sampling procedure due the COVID-19 pandemic. It is recommended that future studies implement randomized sampling strategies to ensure more representative populations and strengthen the validity of the results.

CONCLUSIONS

Food insecurity is prevalent among university students from Indigenous communities in northwest Mexico and is associated with sociodemographic, academic, health, and nutritional behavior characteristics. The qualitative insights gathered from the focus groups further illuminate the personal experiences and coping mechanisms employed by students facing food insecurity. Many participants expressed the psychological toll of hunger, including anxiety and decreased concentration, which adversely affects their academic success. The emerging themes point to systemic issues such as inadequate access to nutritious food, socio-economic disparities, and cultural dislocation, which compound the food insecurity crisis among Indigenous students.

These findings call for targeted interventions that include immediate food assistance and long-term strategies to improve access to affordable, nutritious food. Addressing these needs holistically is crucial for fostering equitable educational environments and supporting the well-being of Indigenous students.

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CONFLICTING OF INTERESTS

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ETHICAL CONSIDERATIONS

The development of the study was carried out in accordance with the Declaration of Helsinki and the protocol was approved by the Research Ethics Committee of the University of Sonora (CEI-UNISON 06/2021).

CONSENT TO PARTICIPATE

Participants provided informed consent in writing.

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