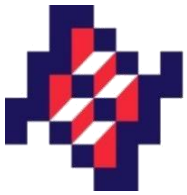

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Patrones de Estilo de Vida y Cambios en el Riesgo Cardiovascular de Hombres y Mujeres de la Cohorte de Trabajadores del IMSS-Morelos.

Tesis para obtener el título de Doctor en Ciencias en Nutrición Poblacional

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Resumen

El estilo de vida ha sido ampliamente estudiado debido a su efecto sobre las enfermedades crónicas. Se sabe que un estilo de vida poco saludable se asocia positivamente con el riesgo cardiovascular. Tradicionalmente, se han estudiado las asociaciones independientes entre los factores de riesgo y los desenlaces cardiovasculares. Sin embargo, cada individuo tiene una combinación diferente de factores de riesgo y protectores, lo que puede modificar la estimación del riesgo final. Un patrón de estilo de vida, es una forma de caracterizar la manera en que vive cotidianamente un individuo. Este término es una medida compuesta que incluye diferentes aspectos del estilo de vida, los cuales están relacionados con la salud. El objetivo de este estudio es identificar los patrones de estilo de vida en hombres y mujeres de una Cohorte de trabajadores del IMSS-Morelos y determinar su asociación con el riesgo cardiovascular tras 6 años de seguimiento.

Se encontraron tres patrones de estilo de vida, Saludable, Hedónico y Mixto. El patrón Saludable presentó el mayor número de factores protectores (baja proporción de sujetos con síntomas depresivos y estrés laboral y un alto nivel de actividad física total, además se observó un bajo consumo de alcohol y tabaco, una dieta alta en frutas y verduras, lácteos bajos en grasa y un bajo consumo de alimentos de origen animal, galletas, cereales refinados, refrescos y antojitos), mientras que el patrón Hedónico tuvo el mayor número de factores de riesgo (alto consumo de alcohol y tabaco, la mayor presencia de estrés laboral y síntomas depresivos y una dieta poco variada, con un alto consumo de carbohidratos refinados (productos de repostería, tortillas y refrescos), por otro lado, el patrón Mixto tuvo una combinación de aspectos positivos y negativos (mayor rotación de horario laboral, mayor tiempo dedicado a realizar actividades de bajo gasto energético-sedentarias, dieta con alto consumo de alimentos de origen animal (pescados y mariscos, aves, carne roja y procesada, mantequilla y huevos), oleaginosas, cereales refinados, galletas y antojitos.

En comparación con el patrón Saludable, el patrón Hedónico mostró una asociación positiva con el riesgo cardiovascular en sujetos mayores de 40 años. Por otro lado, el patrón Mixto, se asoció con un mayor riesgo cardiovascular en el grupo de 26-40 años, comparado con el patrón Saludable.

Los patrones de estilo de vida se asociaron con el riesgo cardiovascular en una cohorte de adultos Mexicanos. Es necesario promover un estilo de vida saludable en esta población, mediante intervenciones que involucren no solo la dieta y actividad física, sino también el manejo de factores psicosociales como el estrés laboral y la depresión, con el fin de tener un mayor impacto en la prevención de eventos cardiovasculares. Es importante continuar estudiando el cambio de los patrones de estilo de vida a través del tiempo y su efecto sobre otros desenlaces de salud.

Contenido

SECCIÓN I.

I.I. Introducción.

Las enfermedades cardiovasculares (ECV) son un grave problema de salud pública a nivel mundial, ya que su prevalencia ha aumentado en los últimos años (1). Las ECV son enfermedades consideradas como complejas, ya que su origen es multifactorial. Dentro de los factores que influyen en la presencia de estas enfermedades se encuentran aspectos relacionados con el estilo de vida; entre los más importantes se encuentran la dieta, actividad física, hábitos (consumo de tabaco, alcohol, horas de sueño) y factores psicosociales (2-10). En diversos estudios, se ha documentado el efecto de cada uno de los factores de riesgo sobre la salud cardiovascular. Sin embargo, los factores no actúan de manera aislada e independiente, pues pueden estar presentes de manera concurrente (11). Además, algunos de estos factores modifican el efecto de otros sobre el riesgo de desarrollar ECV (11). Por lo anterior, el estudio del perfil de riesgo de ECV en una población, debería tomar en cuenta no solo la presencia o ausencia de un factor, sino la inter-relación que existe entre éstos y su efecto sobre la modificación del perfil de riesgo. La determinación de la magnitud del riesgo de ECV, tomando en cuenta las interacciones entre factores de riesgo permitirá identificar subgrupos de población con características particulares y aportará información relevante para el diseño de estrategias poblacionales específicas que ayuden a prevenir la incidencia de ECV, las cuales afectan a miles de Mexicanos cada año (12).

En el presente trabajo, se describirá la epidemiología de las ECV y se explicará la forma en que los diferentes factores de riesgo se relacionan con las ECV. Posteriormente, se describirá la forma en que se ha evaluado el estilo de vida en los estudios epidemiológicos. Por último, se planteará una propuesta para evaluar el estilo de vida mediante la conformación de patrones y su asociación con el puntaje de riesgo cardiovascular de Framingham. En este enfoque, se evaluará la presencia conjunta y la interacción de las

familias de factores de riesgo como son la dieta, actividad física, hábitos (consumo de alcohol, horas de sueño) y factores psicosociales.

I.II. Planteamiento del problema.

Las enfermedades cardiovasculares (ECV) son una de las principales causas de mortalidad en el mundo. Se estima que en el 2010, el 29.59% de las muertes ocurridas en el mundo se atribuyeron a enfermedades cardiovasculares (1). En México, durante el 2012 ocurrieron 215,271 muertes por ECV, ocupando así el primer lugar en las principales causas de mortalidad, seguido por la diabetes con 85, 055 muertes (12).

Las ECV son un grupo de enfermedades que involucran al corazón y los vasos sanguíneos de todo el cuerpo. Su clasificación incluye un gran número de enfermedades, de acuerdo con el sitio de origen del problema, así como sus causas principales. Sin embargo, algunas de ellas se asocian con un estilo de vida poco saludable (enfermedad cardiaca coronaria, enfermedad cerebro-vascular, enfermedad hipertensiva, enfermedades isquémicas del corazón, enfermedad cardiopulmonar, enfermedades de las arterias, de las arteriolas y de los vasos capilares, enfermedades de las venas y de los vasos y ganglios linfáticos) (11, 13).

Ritzer (2007), definió al estilo de vida como un concepto que incorpora diferentes aspectos de la vida diaria, en el que se agrupan comportamientos y actitudes que caracterizan la manera en que vivimos. Dentro de esta definición se incluyen a la alimentación, la actividad física, el nivel de estrés, la ocupación, actividades de ocio, el consumo de tabaco y alcohol, las relaciones interpersonales y factores psicosociales como la ansiedad y la depresión (2).

Diversos factores relacionados con el estilo de vida, determinan el riesgo de padecer ECV. Entre éstos se encuentran una dieta poco saludable (rica en energía, grasas saturadas, trans y colesterol, carbohidratos refinados y sodio, baja en grasas mono y poli-insaturadas y fibra) (3-6, 14). Asimismo, las ECV están asociadas con algunos hábitos dañinos (alto consumo de alcohol y tabaco, bajo nivel de actividad física, sedentarismo y las horas de sueño insuficientes) (7-9, 15-17) y con factores psicosociales (estrés laboral, ansiedad, depresión y ocupación con rotación de turnos) (10, 18-20).

La presencia de ciertos indicadores fisiológicos de desbalance metabólico se han asociado con una mayor mortalidad por ECV, por lo que se utilizan para medir la magnitud del riesgo cardiovascular de un individuo (hipertensión arterial, obesidad, cifras elevadas de glucosa y dislipidemias: colesterol total, LDL, triglicéridos elevados y bajo nivel de HDL) (21-28), así como algunos factores no modificables (sexo, edad avanzada, y predisposición genética) (29-32).

Con el paso del tiempo y la generación de evidencia sólida que demuestra el impacto de los factores antes mencionados sobre el riesgo cardiovascular, se han creado instrumentos de evaluación que, mediante el uso de algoritmos matemáticos, permiten evaluar el riesgo de desarrollar ECV en un individuo. Tal es el caso de la escala de riesgo Framingham (33-37). La medición del riesgo cardiovascular está influida por el gran número de factores involucrados, los cuales tienen efectos sinérgicos o antagónicos entre sí y están presentes de manera simultánea y en diferentes combinaciones (11). Por ejemplo, dentro de la dieta, el consumir altas cantidades de grasa saturada puede significar un alto riesgo, pero al mismo tiempo, existen nutrimentos que tienen un rol protector en la salud cardiovascular, como los ácidos grasos insaturados (6, 38, 39).

Algunos estudios han evaluado si la modificación de algunos factores de estilo de vida afecta el riesgo cardiovascular, pero comúnmente incluyen únicamente un solo factor de riesgo o un par de ellos, por ejemplo la actividad física y la dieta o la dieta y el tabaquismo (21, 40-43). Estos estudios han demostrado que el cambio en la dieta, aunado a un aumento de la actividad física, tiene un impacto positivo sobre algunos biomarcadores metabólicos (resistencia a la insulina, presión arterial, y concentraciones de glucosa y lípidos séricos) (21, 40-43). Estos biomarcadores metabólicos están incluidos en la escala de medición del riesgo cardiovascular Framingham, por lo que la modificación en ellos, puede modificar el puntaje de riesgo de ECV obtenido con este instrumento (33, 35).

Sin embargo, es necesario señalar que un individuo puede tener presentes uno, varios o todos los componentes de las diferentes familias de factores de riesgo de ECV, mientras que otro individuo puede tener una combinación diferente de ellos (11). Un patrón de estilo de vida, es una forma de caracterizar la manera en que vive cotidianamente un individuo. Este término es una medida compuesta que incluye diferentes aspectos del estilo de vida, los cuales están relacionados con la salud (la dieta, hábitos y factores psicosociales) y que

permite clasificar el estilo de vida de un sujeto de acuerdo con la presencia de estos aspectos (44). Los patrones de estilo de vida pueden ayudar a identificar sub-poblaciones con diferente riesgo de enfermedades (44).

Por lo anterior, se desprende la siguiente pregunta de investigación: ¿Los patrones de estilo de vida se asocian con el riesgo cardiovascular?

En el presente estudio se caracterizarán los diferentes patrones de estilo de vida que existen en adultos participantes de la Cohorte de trabajadores del IMSS en Morelos, a través de los siguientes conjuntos de variables de exposición: dieta, actividad física y sedentarismo, hábitos (consumo de alcohol, horas de sueño) y factores psicosociales. Asimismo, se determinará si los patrones se asocian prospectivamente con el puntaje de riesgo cardiovascular medido mediante un instrumento validado en diferentes países, como es la escala de riesgo Framingham (35).

I.III. Marco conceptual

Las enfermedades cardiovasculares.

La Clasificación Internacional de Enfermedades (ICD, por sus siglas en inglés) define a las enfermedades cardiovasculares (ECV) como un grupo de enfermedades del aparato circulatorio que incluyen: enfermedades cardíacas reumáticas crónicas, enfermedades hipertensivas, enfermedades isquémicas del corazón, enfermedad cardiopulmonar y enfermedades de la circulación pulmonar, otras formas de enfermedad del corazón (arritmias, pericarditis, endocarditis, insuficiencia mitral, estenosis aortica, paro cardiaco, fibrilación atrial y falla cardiaca congestiva), enfermedades cerebro-vasculares, enfermedades de las arterias, de las arteriolas y de los vasos capilares, enfermedades de las venas y de los vasos y ganglios linfáticos, y otras formas de enfermedad cardiaca como hipotensión y desórdenes cardiovasculares causados por la presencia de patologías como las enfermedades infecciosas (11, 13).

Las ECV son la principal causa de muerte en el mundo, siendo responsables del 31.53% del total de las muertes ocurridas en 2013; además explican las mayores pérdidas de años de vida ajustados por discapacidad a nivel global (1). La prevalencia de estas patologías es diferente según la zona geográfica, siendo mayor en los países en vías de desarrollo que en los desarrollados. Actualmente se reporta que la prevalencia de estas enfermedades está

aumentando principalmente en países de bajos y medianos ingresos, los cuales aportan aproximadamente el 80% de la carga de la enfermedad en el mundo (1). Se estima que entre 1990 y 2013, la mortalidad por ECV ha disminuido 5.39% en países desarrollados (424.47 muertes por 100,000 habitantes en 1999 vs 401.59 por 100,000 hab. en 2013), mientras que en países en vías de desarrollo la mortalidad por esta causa ha aumentado 17.18% (175.24/100,000 vs 205.35/100,000 habitantes en 1999 y 2013, respectivamente) (45).

Factores de riesgo cardiovascular.

A través del tiempo, numerosos estudios epidemiológicos han demostrado que las ECV son originadas por múltiples causas (46-48). Los factores de riesgo de ECV se clasifican en no-modificables y modificables, dentro de los primeros se encuentra la etnicidad, edad y sexo, mientras que en los modificables se encuentra el estilo de vida: la dieta, la actividad física, el tabaquismo, el consumo de alcohol, las horas de sueño, los factores psicosociales, y factores de riesgo fisiológicos como la hipertensión arterial, la hiperglucemia, la obesidad y las dislipidemias (3-11, 16).

Genética

La mortalidad por ECV es diferente según el grupo racial o étnico al que se pertenezca. Algunos estudios han demostrado que la mortalidad por ECV varía dependiendo del origen étnico (49), mientras que la prevalencia de hipertensión arterial es distinta entre grupos raciales (31). En E.U.A, un país con una gran diversidad de razas, se reportó que en 2011, las ECV representaron el 30.9% y 31.4% de las muertes en hombres y mujeres de raza blanca, mientras que en personas de raza negra fue de 31.4% y 32.9% (hombres y mujeres, respectivamente; las muertes por ECV en hispanos o latinos correspondieron al 26.7% y 29.2% y en nativos americanos, el porcentaje fue de 24.2% en hombres y 23.7% en mujeres (50).

La variabilidad en la mortalidad puede explicarse por las diferencias en la prevalencia de los factores de riesgo cardiovascular que existen entre poblaciones. Por ejemplo, en un estudio de revisión sistemática se reportó que la presencia de hipertensión arterial, así como la historia familiar de esta enfermedad es más frecuente en las personas de raza negra, que en las de raza blanca (OR: 1.86, IC 95%: 1.18–2.94 en hombres y OR: 1.83, IC 95%: 1.28–2.62 en mujeres). En dicho estudio, los hombres México-americanos no mostraron

diferencias en la prevalencia de hipertensión con respecto a la raza blanca, mientras que en las mujeres México-americanas la prevalencia fue mayor que en las mujeres blancas (31). En el caso de la diabetes, las mujeres de raza negra y las mujeres México-americanas tuvieron una mayor prevalencia que las mujeres de raza blanca (OR:2.39, IC 95% 1.74–3.28 en mujeres de raza negra vs raza blanca; OR:3.24, IC 95%: 2.04–5.17 en mujeres México-americanas vs raza blanca) (31).

La prevalencia de los factores de riesgo en diferentes poblaciones puede explicarse en parte por la presencia de mutaciones genéticas (32). Se ha visto que algunas mutaciones están asociadas con un mayor riesgo de ECV y son más prevalentes en ciertas poblaciones que en otras, aunque los mecanismos de acción de la mayoría de ellas se desconoce (32, 51, 52). En México, estudios realizados recientemente han mostrado la presencia de mutaciones genéticas en la población, las cuales están asociadas con patologías como la enfermedad arterial coronaria, la cardiomiopatía dilatada idiopática y con un metabolismo de lípidos alterado (53-55). Un ejemplo de lo anterior es la variabilidad en el gen *SLC16A11*; las mutaciones en este gen son más frecuentes en sujetos con ancestría nativa americana (50%) y poco frecuente en personas con ancestría asiática, europea o africana (10%). La presencia de esta mutación está relacionada con alteraciones en el metabolismo hepático de lípidos (aumento en los niveles de triglicéridos) y se asocia con un aumento del 20% en el riesgo de desarrollar diabetes tipo 2 en población de México y Latinoamérica (56).

Edad

El envejecimiento trae consigo cambios en la morfología y fisiología del corazón. Dentro de estos cambios se encuentran la hipertrofia y función alterada del ventrículo izquierdo, aumento de la rigidez de las arterias y mayor disfunción endotelial (30). Todos estos cambios propician una sobrecarga cardiaca, lo que hace que aumente la tensión arterial y que el corazón sea más susceptible al efecto del estrés (tanto físico como el estrés oxidativo), aumentando los procesos inflamatorios celulares y favoreciendo el desarrollo de ateroesclerosis (30, 57).

Sexo

La prevalencia de enfermedades cardiovasculares es diferente en hombres y mujeres. Esto se atribuye a la exposición a estrógenos endógenos en la mujer durante la edad fértil, los cuales

actúan como un factor protector de ECV (29, 58). Los estrógenos participan en la regulación del metabolismo de los lípidos séricos, en los procesos inflamatorios y en la coagulación de la sangre. También, tienen un efecto vasodilatador sobre las paredes de los vasos sanguíneos retrasando así la manifestación de ateroesclerosis. Después de la menopausia, los efectos protectores de los estrógenos desaparecen y aumentan las concentraciones de lípidos séricos. Esto, aunado a una mayor prevalencia de obesidad y diabetes en las mujeres postmenopáusicas tiene como resultado un aumento en el riesgo de ECV (29, 58).

Factores psicosociales

Existen factores psicosociales que pueden modificar el riesgo de desarrollar una enfermedad cardiaca coronaria, tales como la ansiedad y la depresión. Se piensa que estos factores pueden tener efectos a través de diferentes vías: a) Pueden modificar los comportamientos relacionados con la salud, b) Pueden causar cambios fisio-patológicos agudos o crónicos de manera directa, c) Pueden influir sobre el acceso y tipo de la atención médica del individuo (59). En la literatura, algunos meta-análisis han demostrado que la depresión y la falta de soporte social están asociados a un mayor riesgo de desarrollar ECV y una mayor mortalidad por esta causa (20, 59). Por otro lado, la ocupación que involucra una rotación de turnos frecuente, ha sido también asociada con la presencia de eventos vasculares mayores (infarto al miocardio, eventos coronarios y accidente cerebro-vascular isquémico) (60). Se asume que puede deberse a una disrupción del ritmo circadiano, el cual podría modificar la función endocrina y metabólica del organismo, haciendo más vulnerables a los sujetos que laboran bajo estas condiciones (60).

Actividad física y sedentarismo

La actividad física moderada a vigorosa está asociada con una disminución del riesgo de mortalidad por ECV o por todas las causas (9, 15). Numerosos estudios han reportado que el realizar en promedio 2.5 horas/semana (30 min/día durante 5 días de la semana) de actividad física de intensidad moderada, está asociado con un menor riesgo de mortalidad por todas las causas en 19% (IC 95%: 15-24), comparado con los sujetos que no realizan actividad física (15). Además, se ha demostrado que una mayor actividad física ocupacional y durante el tiempo de ocio se asocia con un menor riesgo de sufrir alguna ECV (9).

El sedentarismo, se define como la presencia de conductas sedentarias frecuentes en un individuo. Las conductas sedentarias son todas aquellas actividades que se realizan estando despierto y en posición sentado o acostado, las cuales implican un gasto de energía <1.5 MET's, tales como trabajar sentado, conducir un automóvil, ver televisión, etc. Se estima que en los países desarrollados, los individuos pasan entre el 55 y 70% de sus horas de vigilia realizando actividades sedentarias (17). Este tipo de conductas afectan el funcionamiento del organismo al disminuir la activación energética del músculo esquelético, lo que estimula una serie de procesos celulares que propician una alteración metabólica, teniendo como consecuencia una intolerancia a la glucosa, hiper-insulinemia y dislipidemias, aumentando así el riesgo de padecer ECV (16).

Tabaquismo

El tabaquismo se considera como un factor de riesgo independiente para el desarrollo de ECV. Se estima que el 16.49% de las muertes por ECV ocurridas en el mundo durante el año 2013, fueron atribuibles al tabaquismo (61). Por otro lado, en el estudio de casos y controles INTERHEART, realizado en población de 52 países, se estimó que las personas que fuman tienen 2.87 veces más posibilidades de sufrir un infarto al miocardio, en comparación con las personas que nunca han fumado (OR: 2.87, IC 95%: 2·58–3·19) (62).

El consumo de tabaco afecta la función cardiovascular por diferentes vías; la nicotina presente en el humo del cigarro tiene un efecto vasoconstrictor y trombogénico en las arterias, aumentando así la frecuencia cardiaca y las cifras de presión arterial (63). Por otro lado, el humo del cigarro tiene altas concentraciones de radicales libres que dañan las células endoteliales y favorecen la oxidación de los lípidos presentes en las lipoproteínas como la LDL-c (lo que aumenta la respuesta inflamatoria sistémica). Cuando las LDL-c presentan signos de oxidación, son reconocidas por los receptores de los macrófagos y digeridas por éstos, formando así células espumosas. Al morir estas células, los lípidos contenidos en ellas son liberados hacia la pared arterial, la acumulación de estos lípidos hace que se formen placas de grasa, lo que acelera el desarrollo de ateroesclerosis (8).

Hipertensión arterial

La hipertensión arterial (28), es un aumento crónico en las cifras de tensión arterial y está considerada como uno de los factores que están fuertemente asociados con un mayor riesgo de desarrollar ECV y daño renal (22). Por cada aumento en 20mmHg en la tensión sistólica o 10mmHg en la diastólica, el riesgo de mortalidad por ECV se duplica (64). Sin embargo, la relación entre la tensión arterial y la morbilidad y mortalidad por ECV está modificada por la presencia del resto de los factores de riesgo cardiovascular, ya que muchos de ellos causan también HTA (Edad, tabaquismo, obesidad, dieta rica en sodio, sedentarismo, etc.), formando así un ciclo en el riesgo cardiovascular (22, 64).

Hiperglucemia y diabetes

La hiperglucemia se define como una concentración de glucosa sérica mayor a las cifras normales, pero sin llegar a clasificarse como diabetes (100-125 mg/dL), mientras que la diabetes se caracteriza por un aumento crónico en la concentración de glucosa sérica (>126mg/dL) (11, 65). Cuando existe hiperglucemia a largo plazo, las moléculas de glucosa sufren un proceso de oxidación, en el que se generan radicales libres, los cuales se adhieren a otras moléculas circulantes, alterando su funcionalidad (28). El aumento en la oxidación molecular (denominado estrés oxidativo) que incluye la oxidación lipídica, propicia que se active la respuesta inflamatoria del organismo, lo que favorece el desarrollo de ateroesclerosis. Además, la acumulación de metabolitos de la oxidación de la glucosa dañan el tejido renal, con lo que se altera la regulación de la tensión arterial, afectando de manera directa la función cardiaca (28). Por lo anterior, se estima que la presencia de diabetes aumenta 2-3 veces más el riesgo de ECV y dicho riesgo es mayor en mujeres que en hombres (11, 26).

Dislipidemias

La concentración elevada de lipoproteínas LDL-c y una disminución en las HDL-c son un fuerte biomarcador de una alteración en el metabolismo de lípidos (11). Un mayor número de LDL-c (≥100mg/dL) (27) aumenta la susceptibilidad de que éstas se oxiden y se depositen en la pared arterial, incrementando el riesgo de ateroesclerosis. A su vez, las HDL-c actúan como un factor protector al remover las grasas de los tejidos y transportarlas al hígado para su degradación, por ello, cuando disminuye su concentración (≤ 40 mg/dL en hombres y ≤50 mg/dL en mujeres), aumenta el riesgo de sufrir ECV (11, 27).

Horas de sueño

Las horas de sueño inadecuadas, tanto la deficiencia, como el exceso tienen efectos negativos en la salud (10). La falta de sueño produce cambios en el metabolismo de glucosa, la respuesta inmune, la función endócrina y la ingestión de energía (18, 19, 66, 67). En un estudio de meta-análisis se reportó que una baja duración en las horas de sueño (≤6 h), se asoció con un mayor riesgo de morbilidad y mortalidad por enfermedad cardiaca coronaria (RR 1.48, IC 95% 1.22–1.80, P<0.0001), accidente cerebro-vascular (RR 1.15, 1.00–1.31, P = 0.047), no así con ECV totales (1.03, 0.93–1.15, P=0.52). Por otra parte, el sueño de larga duración (≥9 h) también se asoció con un mayor riesgo de enfermedad cardiaca coronaria (RR 1.38, 1.15–1.66, P=0.0005), accidente cerebro-vascular (RR 1.65, 1.45–1.87, P <0.0001), y ECV totales (1.41, 1.19–1.68, P<0.0001) (10).

Obesidad

La obesidad es una enfermedad crónica multifactorial en la que intervienen factores genéticos, la dieta y el medio ambiente (23, 68). Numerosos estudios han reportado que la obesidad se asocia con un mayor riesgo de enfermedades crónicas como la diabetes tipo 2 y ECV (11). La obesidad, caracterizada por el aumento excesivo del tejido adiposo, produce un desbalance en el metabolismo de carbohidratos y lípidos, el cual se ve reflejado como un incremento en los marcadores de inflamación, hipertensión arterial, resistencia a la insulina y dislipidemias (23, 69). Algunos meta-análisis han demostrado una asociación entre la presencia de obesidad (índice de masa corporal ≥ 30Kg/m^2) y la mortalidad por ECV y por todas las causas (24, 25).

Dieta

Un gran número de estudios ha demostrado una asociación entre la dieta y el riesgo cardiovascular. El alto consumo de energía y ciertos nutrimentos como los ácidos grasos saturados, ácidos grasos trans, carbohidratos simples, el colesterol y el sodio, tienen un efecto negativo sobre el perfil de lípidos sanguíneos, aumentan la secreción y resistencia a la insulina, favorecen la ganancia de peso y el riesgo de hipertensión arterial, lo que en conjunto incrementa el riesgo de sufrir una ECV (4, 5, 11, 23, 38, 70-72). Por otro lado, un alto consumo de carbohidratos complejos, fibra y un moderado consumo de grasas mono y poli-insaturadas son considerados como un factor protector contra ECV (6, 23, 38, 39, 73, 74). La

evaluación de los componentes de la dieta basada en el contenido de energía y nutrimentos totales ha sido cuestionada. Se argumenta que en la dieta no se ingieren nutrimentos aislados, sino mezclas de alimentos, los cuales contienen un conjunto de compuestos químicos que interactúan entre sí, produciendo diferentes efectos en el organismo (75). Por lo anterior, se ha optado por enfoques más amplios para evaluar la dieta, tal es el caso del uso de índices de calidad de la dieta. En este procedimiento, la dieta se evalúa de manera global tomando en cuenta no solo el consumo de nutrimentos, sino también aspectos como el cumplimiento de los lineamientos dietarios (porciones recomendadas, % de adecuación del nutrimento) y la variedad de la dieta. Así, la dieta se resume en un puntaje que engloba múltiples atributos. Se ha visto que un puntaje alto en diversos índices de calidad de la dieta se asocia con un menor riesgo de mortalidad por todas las causas, enfermedad cardiovascular, cáncer y diabetes tipo 2 (76).

Estilo de vida y riesgo cardiovascular

A pesar de que existe una fuerte evidencia de la asociación de factores de estilo de vida y las ECV, son relativamente pocos los estudios que han evaluado la presencia conjunta de los diferentes factores y la mayoría de estos estudios son ensayos clínicos que se realizan bajo condiciones controladas, poco comunes en la vida cotidiana de la población (41). Frecuentemente, en los estudios observacionales se estudian los factores de riesgo de manera independiente, sin considerar que muchos de ellos coexisten e interactúan entre sí para modificar el riesgo cardiovascular (4-6, 8, 16, 18, 26, 69, 71, 77). Algunos de los estudios que han evaluado al estilo de vida incluyen a la dieta y la actividad física, pero dejan de lado el resto de los factores que pueden agravar o disminuir el riesgo de ECV en un individuo (21, 42, 43).

Es poca la información que existe acerca de cómo un factor de riesgo interactúa con otros (ya sean de riesgo o protectores) y su efecto sobre el riesgo cardiovascular. La presencia de un factor protector cardiovascular podría tener un efecto diferente dependiendo de su frecuencia y cantidad, así como de la presencia del resto de los factores de riesgo de ECV (11). Por ejemplo, un individuo que tiene una dieta rica en grasas, a la vez puede ingerir suficiente fibra y vegetales, realizar actividad física de manera frecuente, no beber alcohol

pero tener cargas elevadas de estrés laboral. Cada combinación de factores podría modificar la estimación del riesgo de sufrir una ECV.

Las escalas de riesgo, un instrumento para medir el riesgo de ECV

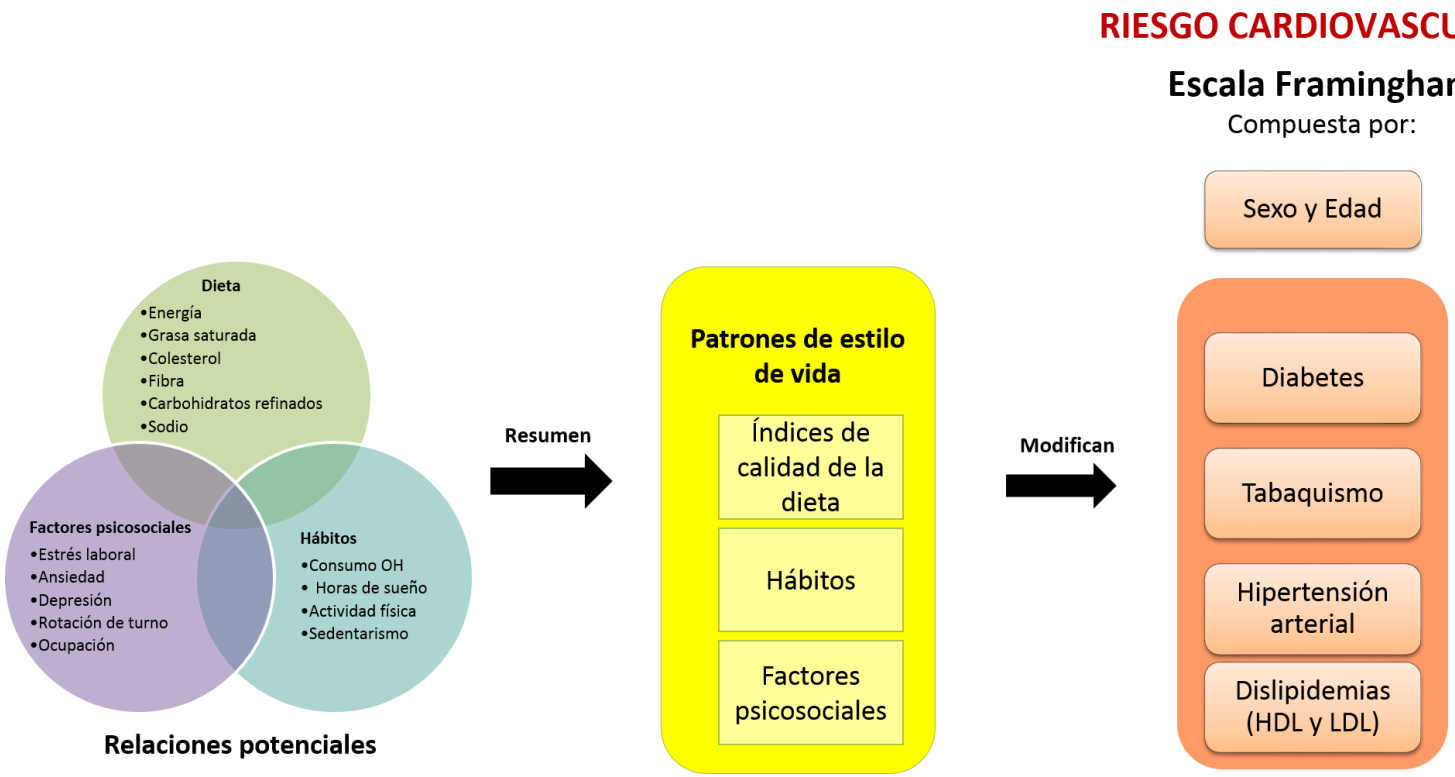
El riesgo cardiovascular de un individuo se puede predecir mediante la aplicación de escalas de riesgo, las cuales se basan en algoritmos matemáticos que calculan un puntaje de riesgo tomando en cuenta la presencia y/o ausencia de los diferentes factores que intervienen en la salud cardiovascular. Dentro de las escalas más utilizadas se encuentran la escala, Heart Score, The Assign Score, QRisk Scale, The Reynolds Risk Score, ATP-III y la Escala de riesgo Framingham (FRS, por sus siglas en inglés). La primera está adaptada para población europea, la segunda para población de Escocia, la tercera fue diseñada para población de Inglaterra y las últimas tres para población estadounidense (34, 36, 37, 48, 78).

La escala de riesgo Framingham ha sido utilizada y validada en 25 estudios de cohorte realizados en diversos países, se ha visto que la versión original y la recalibrada han tenido un buen nivel predictivo en población de Estados unidos, Australia, Suiza, Nueva Zelanda y los Países bajos (33, 35, 79-84). Diversos estudios han comparado la capacidad predictiva de las diferentes escalas para medir el riesgo de ECV. En un estudio de cohorte multi-étnico, donde participaron mujeres post-menopáusicas de E.U.A, se observó que tanto la escala ATPIII y la FRS tienden a sobreestimar el riesgo cardiovascular, comparadas con la escala Reynolds (85). En una población Japonesa, también se observó dicha sobreestimación del riesgo, por lo que en este país se ha optado por el diseño de escalas adaptadas para su población (86). Por otro lado, en una cohorte de Australia, se observó que la FRS no es útil para predecir el riesgo cardiovascular en pacientes diabéticos, ya que la predicción estimada con esta escala fue 28% menor a la incidencia observada en el estudio (87).

En un estudio de revisión sistemática, se reportó que la FRS sobreestima el riesgo de sufrir ECV en la población hispana, si no se recalibra apropiadamente (88). En México, existen pocos estudios que comparen el desempeño de las escalas para medir el riesgo de ECV; en dos estudios se encontraron resultados contradictorios. En un estudio transversal donde se comparó el riesgo de ECV estimado por la escala SCORE y la FRS, se observó una concordancia de 76% entre ambas escalas, además se reportó que la FRS es más útil en población Mexicana, debido a que la SCORE subestima el riesgo (89). Mientras tanto, en un

estudio longitudinal se reportó que la FRS sobreestimó el riesgo de ECV en hombres Mexicanos de bajo nivel socioeconómico, no así en mujeres. En este estudio, los autores recomiendan realizar más estudios en población Mexicana utilizando la escala FRS para confirmar si sobreestima el riesgo de ECV y, de ser así, recalibrar la escala para su posterior aplicación en México (90). No existe una escala diseñada y validada específicamente para la población Mexicana, por ello, a pesar de sus limitaciones, la FRS es una escala muy utilizada para medir el riesgo de ECV en el país (91-94).

Mapa conceptual: Patrones de estilo de vida y su relación con el riesgo cardiovascular



I.IV. Justificación

La mortalidad por enfermedades cardiovasculares es un grave problema en México, pues el número de muertes por esta causa es cada vez mayor (1, 12). En la figura 1, se muestra que en los últimos 14 años, la cifra de defunciones por ECV ha aumentado considerablemente; se estima que en 2012 ocurrieron aproximadamente 59% más muertes por ECV que en 1998 (12). El problema con estas enfermedades no es solamente su alta mortalidad, sino que además, debido a sus complicaciones causan discapacidad física en las personas que la padecen (1). Se calcula que en México las ECV ocupan el segundo y tercer lugar entre las principales causas de años de vida saludable perdidos (AVISA) en hombres y mujeres respectivamente (6.1% y 4.1% del total de AVISA) (95). Lo anterior es importante, ya que los años perdidos por discapacidad repercuten directamente en el costo asociado a la atención médica, pero también en los costos indirectos como las pérdidas en la productividad del individuo y de los familiares y demás individuos que reciben su demanda de cuidados (96, 97). Por ejemplo, en México, durante el 2010 se observó que el costo estimado de atención a ECV incrementó 2.8 veces en los últimos 5 años, pasando de $4, 516, 810 USD en 2005 a $12, 843, 134 USD en 2010 (97).

Un estilo de vida caracterizado por una dieta hipercalórica, rica en grasas saturadas, trans y colesterol, alta en sodio, baja en fibra y grasas poli-insaturadas (98, 99), la presencia de sedentarismo (17), inactividad física (9), alto consumo de alcohol (100) e inadecuadas horas de sueño (10), así como altos niveles de estrés en el trabajo (59), frecuente rotación de turno laboral, presencia de ansiedad y depresión (20) se asocian con un mayor puntaje de riesgo cardiovascular en la escala de riesgo Framingham (33, 35, 80, 81, 83, 84, 98, 99). En México es conocida la alta prevalencia de hipertensión arterial y de obesidad; además, la población tiene un alto consumo de grasas saturadas y colesterol, carbohidratos refinados y sodio, todos ellos factores de riesgo de ECV (101-105).

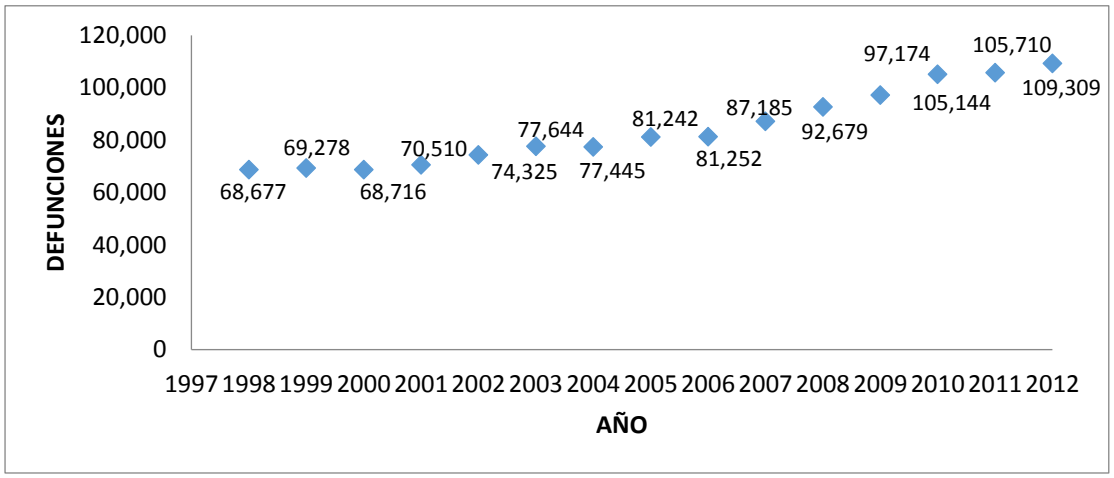
En la actualidad, la mayoría de los estudios evalúan los componentes del estilo de vida y su relación con diversas enfermedades de manera independiente o desagregada (7-9, 11, 14, 16, 25, 58, 60, 65). Son pocos los estudios que han considerado otros factores

importantes como los hábitos (consumo de alcohol, actividad física y sedentarismo), factores psicosociales e indicadores metabólicos que se han visto asociados con el riesgo de ECV, pues únicamente abordan aspectos como la dieta y la actividad física en los grupos estudiados, dejando de lado los demás componentes y su efecto sobre el riesgo cardiovascular (106).

A pesar de que en México se conocen las prevalencias de ciertos factores de riesgo en la población Mexicana, tales como la obesidad, hipertensión arterial, actividad física y aspectos dietarios (101-105, 107), no se ha documentado la forma en que éstos se combinan e interactúan para generar el perfil de riesgo cardiovascular.

Los resultados obtenidos en este estudio permitirán medir la magnitud del impacto de las diferencias en el estilo de vida sobre el riesgo cardiovascular en un grupo de Mexicanos. Al conocer la magnitud del riesgo en cada individuo, el proveedor de servicios de salud podrá elegir una estrategia específica para la prevención de enfermedades cardiovasculares que atienda a los diferentes estilos de vida de los participantes de la cohorte de trabajadores del IMSS de Morelos.

Figura 1. Defunciones por enfermedades del corazón en México, ambos sexos, todas las edades. 1998-2012.



Fuente: Elaboración propia a partir de datos de Estadísticas de Mortalidad del INEGI.

I.V. Hipótesis

Los patrones de estilo de vida se asocian con cambios en el riesgo cardiovascular en hombres y mujeres de una cohorte de trabajadores del IMSS-Morelos.

I.VI. Objetivos.

Objetivo general:

Evaluar la asociación entre los patrones de estilo de vida y cambios en el riesgo cardiovascular en hombres y mujeres adultos de la Cohorte de trabajadores del IMSS-Morelos.

Objetivos específicos:

Identificar los patrones de estilo de vida en hombres y mujeres de una Cohorte de trabajadores del IMSS-Morelos.

Cuantificar el riesgo cardiovascular a partir de la escala Framingham en hombres y mujeres de la Cohorte de trabajadores del IMSS-Morelos.

Evaluar los cambios en el tiempo del riesgo cardiovascular cuantificada a partir de la escala Framingham en hombres y mujeres de la Cohorte de trabajadores del IMSS-Morelos.

Determinar la asociación que existe entre los patrones de estilo de vida y los cambios en el riesgo cardiovascular a través del tiempo en hombres y mujeres de la Cohorte de trabajadores del IMSS-Morelos.

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SECCIÓN II.

Artículo I. Patrones de Estilo de Vida en Adultos Mexicanos. “Lifestyle Patterns in Mexican Adults”.

Title: Lifestyle Patterns in Mexican Adults

Short title: Lifestyle Patterns in Mexican Adults

Authors:

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Abstract

Background: The study of lifestyle patterns has been proposed as an approach to jointly assess the effect of risk factors, behaviors and diet and their relationship to health-disease. The objective of this study is to identify and characterize lifestyle patterns in Mexican adult men and women.

Methods: We studied 5,391 men and women aged 18-59 years in the Health Workers Cohort Study. Sociodemographic and lifestyle information were obtained through self-administered questionnaires. Dietary information was assessed using a semi-quantitative food frequency questionnaire. The derivation of lifestyle patterns was performed through an analysis by k-means type clusters, including the following variables: working time rotation, work stress, depressive symptoms, smoking, activity and physical inactivity, alcohol consumption, sleep and diet (consumption of 23 food groups). Solutions were tested for 2 to 5 conglomerates

Results: Three patterns of lifestyle were identified: "Healthy" (34.0%), "Mixed" (32.0%) and "Hedonic" (34.0%). The "Hedonic" pattern had the highest presence of risk factors (high percentage of alcohol and tobacco consumption, work stress and depressive symptoms, diet was little varied, with a high consumption of refined carbohydrates). The "Healthy" pattern was characterized by a lower presence of depressive symptoms and work stress, a high level of physical activity, low alcohol and tobacco consumption, a better diet (fruits, vegetables, whole grains, fat dairy, low consumption of refined grains, soft drinks, processed and red meat, sweets and snacks). The "Mixed" pattern had a greater rotation of working hours, greater time spent in sedentary activities and diet with high consumption of animal foods.

Conclusions: Three lifestyle patterns were identified in Mexican adults, consisting of different combinations of risk factors, habits and characteristics of the diet. This approach could be useful to evaluate the joint effect of different risk factors and their association with various chronic diseases.

Keywords: Lifestyle patterns, Diet, Physical activity, Smoking, Alcohol consumption, Cluster analysis, Adults.

Background

Lifestyle is a concept that incorporates different aspects of daily life, in which behaviors and attitudes are grouped in ways that characterize the way we live. Included in this concept are diet, physical activity, stress level, occupation, leisure activities, tobacco and alcohol consumption, sleep, interpersonal relationships, and psychosocial factors such as anxiety and depression [1].

There have been studies that demonstrated independent associations between lifestyle factors, and the development of chronic diseases (CD) such as diabetes, many cardiovascular diseases, and some types of cancer. [2-4]. It has been suggested that some habits, such as a Healthy diet (low intakes of saturated fats, trans fat, cholesterol, refined carbohydrates and sodium, and with high intakes of mono and polyunsaturated fats and fiber), and an adequate level of physical activity, may reduce the risk of developing such diseases. Other habits, such as sedentary lifestyle, an unHealthy diet (high in saturated fats, cholesterol, sodium and refined carbohydrates), smoking, high alcohol consumption, and inadequate sleep (less than 6 hours or more than 9 hours) may increase the risk of developing CD [1, 5-12]. On the other hand some psychosocial factors such as the level of work stress, work shift rotations, and the presence of depression, can increase the risk of developing cardiovascular diseases [13, 14].

Some studies indicate that certain unHealthy behaviors are associated with other unHealthy behaviors, or vice versa; that is, subjects with Healthy behaviors are more likely to engage in other Healthy practices. [15-19]. An example is the tobacco use, which is associated with other practices like a lower level of physical activity or higher alcohol consumption [15]. It has been shown that the interrelation of factors (preventative or risky) is not the same in all individuals, but instead depends on an individual's characteristics, such as age, education, sex, and other aspects related to the socio-demographic context [16, 20, 21].

In Mexico, CD are a major health problem because of their current magnitude and high incidence [22]. On the other hand, although the prevalence of certain risk factors like obesity, arterial hypertension, physical activity and dietary factors in the population is known in Mexico [23-32], the information for each factor is presented in an isolated manner.

Additionally, the study of lifestyle, seen in a global manner, is limited in Mexico – existing studies have focused exclusively on the joint analysis of diet and physical activity [33, 34], or alcohol consumption and smoking [35], without taking into consideration the presence of other lifestyle factors that could modify the final effect on the individual health.

For the above, it is necessary to study the global behavior of people and to analyze how lifestyle components of Mexican adults are grouped. Therefore, the objective of this study was to characterize lifestyle patterns that exist in Mexican adult men and women. In addition, we intend to evaluate the association of the lifestyle with certain socio-demographic aspects of the population.

Methods

Researchers performed a cross-sectional analysis among men and women aged 18 to 59 years, using data from the baseline evaluation of the Health Workers Cohort Study (HWCS). The details of the study (design and methodology) have been previously described in other publications [36-38].

In short, the cohort was a prospective study design and its baseline stage began in 2004-2006, with the objective of studying the association between lifestyle factors and the occurrence of chronic diseases. The cohort was followed for 6 years and included workers from the Mexican Social Security Institute (IMSS), workers and their families from the National Institute of Public Health (INSP) and the Autonomous University of the Mexico State (UAEMex) [38]. All participants signed a letter of informed consent at the time of entering the original study, which was approved by the Commissions of Ethics and Research of the participating institutions: the Mexican Social Security Institute (12CEI 09 006 14), the National Institute of Public Health (13CEI 17 007 36), and the Autonomous University of the Mexico State (1233008X0236) [38].

For the purposes of this study, we used data from 8,134 workers of the IMSS, INSP and UAEMex, from 18 to 59 years old, who participated for the first time in the study during the period of 2004-2006. We removed subjects who did not have dietary information from the analysis (n=192), as well as those whose records had incomplete information in other lifestyle variables (n=2069) and/or implausible dietary data in the areas of interest (n=482) according

to procedures established by Ramirez et al (>3SD from the average) [39]. Thus, the final sample consisted of 5,391 individuals, of whom 66.4% were women and 33.6% were men.

Lifestyle Variables

Dietary Evaluation

We obtained dietary information through the application of a semi-quantitative food frequency questionnaire, previously validated among the Mexican adult population [40]. The questionnaire included data related to the consumption of 116 foods, with standardized portions defined for each food. The frequency of consumption was reported for the last 12 months. Participants chose between 10 possible responses: never, less than 1/month, 1-3 times/month, 1/week, 2-4/week, 5-6/week, 1/day, 2-3/day, 4-5/day, and 6 or more/day. The frequency reported for each food was expressed as daily consumption (portions/day). To calculate the total energy consumed, we added the intake of all foods together [37]. We determined nutrient consumption using food composition databases developed by the INSP [41].

We created 23 food groups according to their nutritional properties: potatoes, fresh fruits, oils and oilseeds, fresh vegetables, legumes, pastries, refined cereals, whole grains, fish and shellfish, high-fat dairy products, low-fat dairy products, fruit juices, corn tortillas, soda, poultry, processed meats, red meat, butter and margarine, cookies, eggs, sweets, high-fat Mexican dishes, unprocessed sweetened beverages. Researchers estimated the percentage of energy contributed by each group of food consumed, with respect to the total caloric consumption ([Kcal of the food group * 100] / Kcal total per day). We transformed the intakes of each food group into Z scores to standardize the scales of dietary variables. [26, 42, 43].
In addition, we classified diet by two different diet quality indexes, in order to compare not only the most consumed food groups within each lifestyle pattern, but to compare the overall dietary quality by means of a total assigned score. These we calculated according to instruments that have been widely studied throughout the world, the Diet Quality Index Revised (DQI-R) and the Healthy Eating Index (HEI). The DQI-R consists of 10 sections, which assess the adequacy of total fat, saturated fat and cholesterol, consumption of grains, fruits and vegetables, consumption of calcium and iron, the variety in the diet (23 food

groups), and foods that should be consumed in moderation (sugars, sodium, alcohol and added fat). Each section provides a score, so that the final score can be between 0 and 100 points, where values close to zero indicate a poor diet and values close to 100 indicate an excellent diet [44].

On the other hand, HEI is based on the evaluation of 10 sections, which analyzes the consumption of food groups (in portions), the percentage of adequacy of specific nutrients and the variety of the diet (through counting the different foods consumed). The rating of this index ranges from 0 to 100 points, a high score reflects the fulfillment of nutritional requirements and corresponds to a better diet [45].

Total Physical Activity and Low Energy Expenditure (Sedentary Activities)

To estimate the level of physical activity, we used a questionnaire that has been previously applied in the Spanish language and validated in longitudinal studies [46, 47]. This questionnaire reported the frequency of various activities during the day, as well as the duration of each activity. The activities were classified as total physical activity (min/day of activities of daily living, leisure and work, without taking into account sedentary activities) and activity of low energy expenditure (sedentary) [38, 48].

Alcohol Consumption

Alcohol consumption was measured with a semi-quantitative food consumption frequency questionnaire. In the drinks section, there were questions about the consumption of eight types of alcoholic beverages during the last year, with 10 response options for the frequency of consumption (never, <1 times/month, 1-3/month, 1/week, 2-4/week, 5-6/week, 1/day, 2-3/day, 4-5/day and 6 or more/day). The amount consumed had 11 response options (from zero to more than 15 drinks) [38, 40]. To calculate the average daily consumption for each subject, the frequency of consumption was multiplied by the quantity consumed and the result was divided between the 7 days of the week.

Alcohol consumption was classified into 4 categories: non-drinkers (0 drinks/day), moderate drinkers (≤1 drink/day in women and ≤2 drinks in men), hard drinkers (2-4 drinks/day in women and 3 -4 drinks/day in men) and compulsive drinker (5 or more drinks at once, for both sexes) [49].

Tobacco Use

The information about tobacco use was collected through a standardized self-administered questionnaire, which was manually coded and processed by optical reading. Active smoking was defined according to the World Health Organization (WHO); that is, those subjects who reported smoking at present and those who had a history of having smoked 100 or more cigarettes in the past. We used 2 categories: non-smoker and current smoker or ex-smoker [36].

Hours of Sleep

Hours of sleep were measured by a questionnaire of activities that participants carried out during the day, part of which was the number of hours that they slept on average per day [48]. They were classified into 2 categories: adequate (6-8 h/day) and inadequate (<6 or> 9 h/day) [12].

Presence of Depressive Symptoms

Depression was determined by the CES-D (Center for Epidemiologic Studies, Depression Scale), which consists of 20 questions that measure the most important symptoms of depression (interpersonal affective relationships, activity level and somatization). Each question is answered using a Likert scale with scores of 0 to 3, according to the intensity and frequency of the symptom during the prior week. A total score lower than 16 points indicates absence of depressive symptoms, whereas a score >16 is used to identify the presence of depressive symptoms and/or a probable case of major depression [50].

Work Stress

Work-related stress was measured by a scale of 4 items. Subjects were asked about their perception of their work. Each question was answered using a Likert scale with grades from very satisfactory to very unsatisfactory. A final score was calculated from the four questions and a categorical variable was created that represented the absence or presence of work stress [51].

Rotation of Working Hours

Based on work shift information (morning, afternoon, night, cumulative or variable), the variable of time spent working was constructed to identify subjects with a fixed working schedule (without working time rotation) or a variable schedule (with a rotation of working hours).

Socio-demographic Characteristics

Data were collected through a self-administered questionnaire that included aspects such as gender, age, education, marital status, occupation and work shift, among others [38].

Statistical Analysis

We performed an exploratory analysis of sociodemographic and lifestyle variables to determine their distribution in the sample. For the continuous variables we calculated the mean, median, standard deviation, and interquartile range and we calculated proportions for categorical variables.

Lifestyle Patterns: We identified lifestyle patterns by using the cluster analysis method. The following variables were included with a dichotomous scale (presence/absence): work hour rotation, work stress, presence of depressive symptoms, and current smoking. We classified alcohol consumption into 2 categories (low-moderate and hard-binge) [49], while sleep hours were also 2 categories (adequate and inadequate). Continuous variables were transformed into dichotomies, obtaining 2 quantiles, from the median of each variable: total physical activity (min/day), activities with low energy expenditure (min/day), as well as dietary variables (low or high consumption of each 23 food groups previously described in the dietary assessment section, according to their contribution percentage of total energy consumed). The k-means method was used to classify the subjects into non-overlapping groups. We tested solutions for 2 to 5 clusters, selecting the most appropriate according to their interpretability and consistency with other studies.

Subsequently, we carried out a descriptive analysis of lifestyle patterns, in order to characterize them according to the distribution of their components. We analyzed the distribution of lifestyle patterns (as the independent variable) according to socio-demographic variables (sex, age, education, and marital status) and diet quality scores (HEI and DQI-R) to see if there was a different behavior in lifestyle patterns within these variables. For the above we used a one-way ANOVA tests, with a significance level of 0.05 and a confidence of 95%. All statistical analyzes were performed with the STATA® statistical software package, version 12.0.

Results

Table 1 shows the general characteristics of the participants, as well as the distribution of the variables that make up the lifestyle patterns. A total of 5,391 adults participated, with a mean age of 38.2 ± 10.1 years. Of the total sample, 66.4% were female and 33.6% were male.

Lifestyle patterns

We identified three lifestyle patterns (LP), characterized by differences in diet, alcohol consumption, smoking, hours of sleep, total physical activity level, time spent during sedentary activities, presence of work rotations and stress, and depressive symptoms (Table 2):

LP-Healthy: characterized by low consumption of alcohol and tobacco, high level of total physical activity and the lowest proportion of subjects with work-related stress and depressive symptoms, compared to the other three lifestyle patterns (Table 2). In addition, this pattern involved a Healthy diet (high consumption of fruits, vegetables, legumes, whole grains, low-fat dairy, fruit juices, flavored waters and low consumption of refined grains, soft drinks, processed meats, red meat, cookies, eggs, sweets and snacks). Table 3.

LP-Hedonic: subjects in this pattern had a high consumption of alcohol and tobacco, a greater proportion of inadequate hours of sleep, greater presence of work stress and depressive symptoms, as well as a lower total physical activity compared to the subjects in the other patterns (table 2). The diet was poor in nutrients, with a high consumption of refined carbohydrates (baked products, tortillas, and soft drinks), it was also the pattern that had the

lowest consumption of fruits, vegetables, seed oils, legumes, whole grains, dairy, poultry and fish And seafood). Table 3.

LP-Mixed: subjects in this pattern had a higher percentage of work hours and spent more time engaging in low energy-sedentary activities compared to other patterns (Table 2). In addition, they had a Mixed diet with high consumption of animal foods (fish and seafood, poultry, processed meat, red meat, butter, margarine and eggs, but also showed a high consumption of seed oils, refined grains, cookies and snacks). Table 3.

Association between lifestyle patterns with socio-demographic variables and diet quality.

The Healthy lifestyle pattern had the highest proportion of women, whereas the Hedonic pattern had the highest of men ($p < 0.05$). On the other hand, differences between the three patterns differed with respect to the average age of the participants, subjects with LP-Healthy had on average the highest age and subjects of LP-Mixed had the lowest average age. When analyzing the distribution of the LPs according to education, we observed that the subjects in LP-Healthy had a higher professional educational level (70.6%), whereas the individuals of the LP-Hedonic had the greater percentage of subjects with basic and intermediate education (42.7%). With respect to marital status, the LP-Healthy had the highest proportion of married or stable partners. Finally, when the overall quality of the diet was analyzed, LP-Healthy had the highest average score in diet quality (HEI: 55.5 ± 5.3 and DQI-R: 73.0 ± 9.9 points, $p < 0.05$), the LP-Mixed had an intermediate rating (HEI: 54.3 ± 5.2, DQI-R: 62.6 ± 11.9 points), and the LP-Hedonic had the lowest diet quality according to HEI and an intermediate quality according to the DQI-R index (HEI: 49.5 ± 6.3, DQI-R: 64.1 ± 11.4 points). Table 4.

Discussion

We identified 3 lifestyle patterns by habits (diet, alcohol consumption, smoking and total physical activity, hours of sleep) and psychosocial factors (work stress And presence of depressive symptoms). These lifestyles were associated with sociodemographic aspects such as gender, age and schooling.

The LP-Healthy was characterized by a low proportion of subjects with depressive symptoms and work stress and a high level of total physical activity. Additionally in this group we observed a low consumption of alcohol and tobacco, a diet high in fruits and vegetables, low fat dairy and low consumption of animal foods, cookies, refined cereals, soda and snacks. This pattern had mostly of older women and a higher level of education compared to all other patterns. LP-Hedonic had a high consumption of alcohol and tobacco, a greater presence of work stress and depressive symptoms and less varied diet, with a high consumption of refined carbohydrates (baked goods, tortillas and soft drinks). The Hedonic lifestyle was more frequent among younger men, with a basic and mid-level schooling. The LP-Mixed included more hours of work, and also more time engaging in sedentary activities or of low energy expenditure. The diet in this pattern was characterized by a high consumption of food of animal origin (fish and seafood, poultry, red and processed meat, butter and eggs), but also a high consumption of oilseeds, refined grains, cookies, and snacks.

Although few studies have analyzed different lifestyle patterns at the population level, the findings observed in this cohort are similar to those found in two studies, one conducted in the U.S.A. and another in the Netherlands. The lifestyle patterns described in this study coincide with the lifestyles reported by Patterson et al. (1994) in U.S.A., in which they studied 5,484 adults. In that study they observed a health-promoting lifestyle (good quality diet, high level of physical activity and low consumption of tobacco), a passive lifestyle (unHealthy diet, low physical activity and moderate consumption of alcohol and tobacco), and a Hedonic lifestyle (unHealthy diet, low physical activity and high consumption of alcohol and tobacco) [15].

In our study, LP-Healthy was similar to the health-promoting lifestyle in terms of the presence of a Healthy diet and high level of physical activity, as well as the low consumption of tobacco. However, in our study this pattern also had a low consumption of alcohol. On the other hand, the Hedonic lifestyle described by Patterson et al. (1994) shows similar characteristics to LP-Hedonic reported in our study, since in both a high consumption of tobacco and alcohol is predominant, although in this study a higher level of stress and depression was also observed.

In the Netherlands, de Vries, et al. (2008) studied 9,449 subjects 12 years of age and older, who were cohort participants and found 3 lifestyles: "Healthy" (high probability of covering the recommendation of physical activity and alcohol consumption, moderately likely to comply with tobacco consumption recommendations and consumption fruits and vegetables), "unHealthy" (low probability of complying with recommendations for physical activity, fruit and vegetable consumption and moderately likely to cover alcohol and tobacco consumption recommendations) and "poor diet" (unlikely to cover the recommendations of physical activity, moderately likely to comply with the norm of consumption of alcohol and tobacco and very low probability to fulfill the recommendation of consumption of fruits and vegetables) [52]. In general, the lifestyles reported by de Vries et al. (2008) are similar to those found in this study. Subjects with a "Healthy" lifestyle were most likely to adhere to the recommendations of eating fruits, vegetables, tobacco, alcohol, and physical activity. The above is similar to the LP-Healthy of this study, in which a high consumption of fruits and vegetables, a low consumption of alcohol and tobacco and a high level of physical activity were observed. On the other hand, the "unHealthy" lifestyle had low probabilities to meet the recommendations of fruit and vegetable consumption, tobacco and alcohol and physical activity, which coincides with the characteristics of the LP-Hedonic reported in this work.

The percentage of smokers found in the sample (21.3% in total, 18.6% of women and 26.9% of men) was similar to that reported in the same period for the national population [53], where about 10% of women and 30% of men smoked (20-59 years old), but the proportion of women who smoked was almost double than that nationally. Contrary to what was expected, the proportion of smokers was higher in the sample, even though the majority of participants worked in the healthcare sector.

Regarding alcohol consumption, in 2006 34.1% of Mexican adults consumed alcoholic beverages daily or occasionally (18.5% of women and 53.1% of men) [54]. In this study, 18.9% of the participants were classified as hard-drinking drinkers. Despite being health workers, their socioeconomic status, level of education, the fact that it is an exclusively urban population, and the level of work-related stress reported may partially explain this phenomenon.

As previously mentioned, the LP-Hedonic had the highest percentage of smokers and alcohol consumers, and had the highest proportion of men compared to the rest of the lifestyle patterns. Previous studies have shown a difference in alcohol and tobacco use in men and women over time, with higher rates in in men. However in recent years use has increased significantly in women, so the difference has decreased [15, 55]. This pattern coincides with the results of this study, since the LP-Healthy (characterized by a lower consumption of alcohol and tobacco) had the highest proportion of women compared to other patterns.

The diet observed in this study coincides with the data reported in a national sample of Mexican adults, where 3 principal dietary patterns were found: *refined foods and sugars (high alcohol consumption, sugary drinks, white bread, fast food and sweets), traditional (high consumption of tortillas and legumes), and a diverse pattern (varied consumption of food, high consumption of animal foods)* [26]. Thus, the LP-Hedonic in this study coincides with the dietary pattern of refined foods and sugars, while the Mixed pattern of this study is similar to the diverse diet.

Over time, an increase in the consumption of food with a high content of added sugars and saturated fat has been documented in the Mexican population [27, 28, 30, 56]. In this study, two of the lifestyle patterns show a high consumption of processed foods rich in saturated fat and sugars. This was the case in the LP-Hedonic, where there was a high consumption of bread products, pastries and sugary drinks, while in the Mixed pattern there was a high consumption of processed meats, cookies and snacks.

Consumption of certain food groups is shown to be different according to the socioeconomic level of individuals. For example, those in a high socioeconomic level are more likely to consume fruits, vegetables, dairy products and those rich in saturated fat and added sugars, with a lower probability of consuming legumes [32]. In this study, although the socioeconomic level of the participants was not included, we analyzed the association of the LP with the education of the participants (which can be taken as a proxy of the socioeconomic level). The LP-Healthy diet (with a higher consumption of fruits, vegetables and low-fat dairy products, among others) was associated with higher (professional) education. In the LP-Hedonic, characterized by a diet low in variety and high in refined carbohydrates, we found mostly among subjects with basic and mid-level education.

In relation to physical activity, the participants in this study are less active than the general Mexican population. This could be explained by their work characteristics, which favor physical inactivity and sedentarism. Previously, it has been reported that health professionals have a high prevalence of physical inactivity and sedentary lifestyle [57-60].

As for the presence of depressive symptoms, according to the National Health and Nutrition Survey 2006 (ENSANUT) data, the national prevalence in adults during that period was 12.7% in women and 3.4% in men [61], whereas in this study the percentage was much higher (30.3% in women and 20.5% in men). On the other hand, the presence of depressive symptoms was greater in the subjects with work stress, compared to the subjects who did not present work stress (32.5 vs 17.7%, $p < 0.01$. This may be due to the fact that the evaluated subjects are health workers and most of them have jobs that carry a high level of stress, which favors the development of symptoms related to depression, such as fatigue, physical exhaustion or anxiety [62-64].

One of the strengths of this study is that it characterized the different lifestyles among a sample of urban adult men and women, which has not previously been documented for the Mexican population. The large sample size and the use of a validated instrument to evaluate the diet enhanced the internal validity of the study. On the other hand, this study presented the same limitations inherent in the methods of diet evaluation (self-report, subjective decisions for the conformation of food groups and dietary patterns). Another limitation was the imprecision in accurate measurement of variables such as the levels of work stress and physical activity. Additionally, the results cannot be extrapolated to the whole Mexican adult population due to the specific characteristics of the sample, comprised mainly of urban adults.

Conclusions

In this study of Mexican urban adults, we identified 3 clearly defined lifestyle patterns among health workers, which were different in relation to age, sex, dietary aspects, physical activity, alcohol and tobacco consumption, hours of sleep, presence of work stress, and depressive symptoms. Within these 3 patterns there was one with a healthier profile, one less Healthy, and one intermediate in relation to factors that, at the individual level, have shown associations with the risk of adverse health outcomes.

As evidenced in the present study, there were different combinations of risk factors within the lifestyles of urban Mexican adults. We propose the study of lifestyle as a potentially useful and comprehensive alternative to the analysis of isolated risk factors in relation to chronic diseases. It is necessary to evaluate the impact of lifestyle patterns to the risk of developing chronic diseases in the Mexican population.

List of abbreviations

CD: Chronic disease, **HWCS**: Health Workers Cohort Study, **IMSS**: Mexican Social Security Institute (acronym in spanish), **INSP**: National Institute of Public Health (acronym in spanish), **UAEMex**: Autonomous University of the Mexico State (acronym in spanish), **HEI**: Heatlhy Eating Index, **DQI-R**: Diet Quality Index-Revised, **WHO**: World Health Organization, **CES-D**: Center for Epidemiologic Studies Depression Scale, **LP**: Lifestyle pattern. **ENSANUT**: National Health and Nutrition Survey.

Declarations

Ethics approval and consent to participate

The present study corresponds to a secondary source analysis of the Health Workers Cohort Study (HWCS). The original study was approved by the Commissions of Ethics and Research of the participating institutions: the Mexican Social Security Institute (12CEI 09 006 14), the National Institute of Public Health (13CEI 17 007 36), and the Autonomous University of the Mexico State (1233008X0236). All participants signed a letter of informed consent at the time of entering the original study. For the present analysis, we had authorization by the HWCS, and the approval from the research ethics committee of the National Institute of Public Health of Mexico.

Consent for publication

Not applicable. This is an analysis of secondary data from the Health Workers Cohort Study (HWCS), who had an informed consent for the collection of information. The data analyzed in this study were anonymized, so no personal data were obtained in any form.

Availability of data and material

The data that support the findings of this study are available from the Health Workers Cohort Study (HWCS), but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the HWCS.

Competing interests

LSVC, MEF, CB, AIBG, EDG, JS declare they have no conflicts of interest.

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Not applicable

Authors' contributions

LSVC and MEF conceived and designed the study. LSVC, MEF and CB performed the statistical analysis. CB, AIBG, EDG, and JS guided the theoretical framework and literature review. LSVC, MEF, and CB led the preparation and drafting of the manuscript. All authors participated equally in the discussion of results, and contributed ideas to the writing of the discussion.

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Table 1. Overall characteristics of Men and Women from the HWCS study.

VARIABLE	Total (n=5391) %	Women %	Men %	p
Sex		66.4	33.6	
Age (years)	38.2 ± 10.1	37.9 ± 9.9	38.9 ± 10.3	**<0.01**
<20	2.2	2.2	2.2	0.94
20 a 29	20.6	21.1	19.6	0.17
30 a 39	30.9	31.1	30.4	0.59
40 a 49	31.8	32.5	30.5	0.15
50 a 59	14.5	13.1	17.3	**<0.01**
Education				
Basic (Elementary school)	14.4	13.8	15.5	0.12
Mid-level (High-school)	19.5	20.4	17.5	**0.02**
Higher (bachelor or graduate degree)	66.1	65.8	67.0	0.41
Marital status				
No stable partner	34.8	41.9	20.8	**<0.01**
Stable partner	65.2	58.1	79.2	**<0.01**
Rotation of Working Hours	18.0	14.3	25.2	**<0.01**
Work stress	63.1	64.3	60.8	**0.01**
Presence of Depressive Symptoms	27.0	30.3	20.5	**<0.01**
Hours of sleep (per day)	6.9 ± 1.2	6.9 ± 1.2	6.8 ± 1.2	0.06
Tobacco consumption (% smokers and ex smokers)	47.6	40.5	61.5	**<0.01**
Alcohol consumption (hard-binge)	19.2	9.5	38.3	**<0.01**
Total physical (minutes/day)	570.7 ± 168.1	585.5 ± 167.0	541.4 ± 166.5	**<0.01**
Low energy expenditure activities (sedentary)	160.2 ± 103.6	153.6 ± 100.5	173.3 ± 108.2	**<0.01**
Healthy Eating Index	53.2 ± 6.1	54.1 ± 5.8	51.4 ± 6.4	**<0.01**
Diet Quality Index (Revised)	66.6 ± 12.0	66.0 ± 12.3	68.0 ± 11.4	**<0.01**

Comparison of means by Anova test of one way to 95% confidence, significance p <0.05. Comparison of proportions by chi-square test. Significance p <0.05.

Table 2. Distribution of components of lifestyle patterns (habits and psychosocial factors).

	LIFESTYLE PATTERNS (n=5391)			
	Healthy	**Hedonic**	**Mixed**	
COMPONENTS	**%**	**%**	**%**	**P**
n (%)	1831 (34.0)	1830 (34.0)	1730 (32.1)	
Consumo de alcohol (empedernido-compulsivo)	10.3[a]	28.7[b]	19.1[c]	**<0.01**
Tobacco consumption (% smokers and ex smokers)	39.7[a]	53.6[b]	49.8[c]	**<0.01**
Total Physical activity (minutes/day)-quantile 2	61.6[a]	44.3[b]	58.0[c]	**<0.01**
Low energy expenditure activities-sedentary (minutes/day) – quantile 2	55.3[a]	44.3[b]	61.9[c]	**<0.01**
Hours of sleep (inadequate: <6 y >9h/day)	12.0[a]	15.4[b]	12.5[a]	**<0.01**
Rotation of Working Hours (Yes)	11.9[a]	12.4[a]	16.9[b]	**<0.01**
Work stress (Yes)	55.3[a]	71.7[b]	62.7[c]	**<0.01**
Presence of Depressive Symptoms (Yes)	19.9[a]	31.7[b]	29.6[b]	**<0.01**

Comparison of proportions by chi-square test. Significance $p < 0.05$. [abc.] Different letters per column indicate significant differences between the variables according to the lifestyle pattern.

Table 3. Distribution of components of lifestyle patterns (dietary aspects).

Food groups (% total energy)	Median (p25-p75)	LP-Healthy	LP-Hedonic	LP-Mixed	P	Food groups (% total energy)	Median (p25-p75)	LP-Healthy	LP-Hedonic	LP-Mixed	p
		% subjects with high consumption (quantile 2)						% subjects with high consumption (quantile 2)			
Potatoes	0.8 (0.4 - 1.7)	61.2[a]	29.9[b]	58.7[a]	**<0.01**	Corn tortillas	7.4 (2.6 - 12.5)	36.5[a]	74.0[b]	38.9[a]	**<0.01**
Fresh fruits	14.9 (8.3 - 25.0)	84.4[a]	25.6[b]	36.8[c]	**<0.01**	Sodas	1.6 (0.7 - 4.2)	23.3[a]	63.2[b]	60.6[b]	**<0.01**
Oils and oilseeds	0.7 (0.4 - 1.2)	55.5[a]	25.6[b]	69.9[c]	**<0.01**	Poultry	5.5 (2.6 - 8.2)	53.9[a]	41.3[b]	57.8[c]	**<0.01**
Fresh vegetables	3.9 (2.6 - 6.0)	79.5[a]	19.0[b]	49.0[c]	**<0.01**	Processed meats	2.1 (1.3 - 3.4)	24.4[a]	75.1[b]	77.4[c]	**<0.01**
Legumes	1.0 (0.6 - 1.7)	55.2[a]	39.5[b]	48.3[c]	**<0.01**	Red meats	5.6 (3.5 - 8.8)	28.7[a]	48.6[b]	76.0[c]	**<0.01**
Pastries	3.6 (1.5 - 7.1)	36.1[a]	67.6[b]	48.4[c]	**<0.01**	Butter and margarine	0.1 (0.0 - 0.1)	35.6[a]	41.3[b]	74.1[c]	**<0.01**
Refined cereals	9.9 (6.6 - 14.1)	39.4[a]	52.7[b]	63.4[c]	**<0.01**	Cookies	0.9 (0.4 - 2.8)	38.8[a]	51.8[b]	64.0[c]	**<0.01**
Whole grains	0.2 (0.1 - 0.9)	67.7[a]	21.2[b]	64.9[a]	**<0.01**	Eggs	0.8 (0.3 - 1.7)	38.5[a]	54.2[b]	55.0[b]	**<0.01**
Fish and shellfish	1.6 (1.0 - 2.5)	54.1[a]	23.2[b]	71.1[c]	**<0.01**	Sweets	1.4 (0.8 - 2.4)	34.0[a]	39.3[b]	80.7[c]	**<0.01**
High-fat dairy products	11.3 (6.6 - 17.6)	51.1	50.6	50.2	0.86	High fat Mexican dishes	2.5 (1.6 - 4.0)	27.1[a]	46.1[b]	73.5[c]	**<0.01**
Low-fat dairy products	0.7 (0.1 - 4.0)	62.6[a]	35.1[b]	56.0[c]	**<0.01**	Unprocessed sweetened beverages	3.2 (1.0 - 8.6)	57.2[a]	51.4[b]	47.2[c]	**<0.01**
Fruit juices (unprocessed)	0.9 (0.3 - 2.7)	69.6[a]	34.7[b]	47.7[c]	**<0.01**						

Comparison of proportions by chi-square test. Significance p <0.05. [abc.] Different letters per column indicate significant differences between the variables according to the lifestyle pattern.

Table 4. Distribution of lifestyle patterns according to socio-demographic variables and quality of diet.

	LIFESTYLE PATTERNS (n=5,391)			
	LP-Healthy	**LP-Hedonic**	**LP-Mixed**	
VARIABLE	**%**	**%**	**%**	**P**
Sex				
Women	79.4[a]	53.0[b]	66.0[c]	
Men	20.6[a]	47.0[b]	34.0[c]	**<0.01**
Age (Years, mean ± SD)	40.1 ± 9.8[a]	38.0 ± 10.2[b]	36.6 ± 9.9[c]	**<0.01**
<20	1.0[a]	2.6[b]	2.9[b]	
20 a 29	15.9[a]	21.5[b]	24.5[c]	
30 a 39	28.8[a]	29.7[a]	34.2[b]	
40 a 49	35.4[a]	32.5[a]	27.6[b]	**<0.01**
50 a 59	18.8[a]	13.8[b]	10.9[c]	
Education				
Basic (Elementary school)	12.4[a]	20.4[b]	10.8[a]	
Mid-level (High-school)	16.9[a]	22.3[b]	19.4[ab]	**<0.01**
Higher (bachelor or graduate degree)	70.6[a]	57.3[b]	69.8[a]	
Marital status				
No stable partner	37.3[a]	29.7[b]	37.0[a]	**<0.01**
Stable partner	62.7[a]	70.3[b]	63.0[a]	
Healthy Eating Index (score, mean ± SD)	55.5 ± 5.3[a]	49.5 ± 6.3[b]	54.3 ± 5.2[c]	**<0.01**
Diet Quality Index-Revised (score, mean ± SD)	73.0 ± 9.9[a]	64.1 ± 11.4[b]	62.6 ± 11.9[c]	**<0.01**

Comparison of means by Anova test of one way to 95% confidence, significance p <0.05. Comparison of proportions by chi-square test. Significance p <0.05. [abc.] Different letters per column indicate significant differences between the variables according to the lifestyle pattern.

SECCIÓN III.

Artículo II. Patrones de Estilo de Vida y Riesgo Cardiovascular en Adultos Mexicanos. Lifestyle patterns and cardiovascular risk in Mexican adults.

Lifestyle patterns and cardiovascular risk in Mexican adults.

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Abstract

The aim of this study is to determine the lifestyle patterns in Mexican adults and their association with cardiovascular risk. **Methods:** A longitudinal analysis was performed on men and women aged 18 to 59 from the Health Workers Cohort Study (HWCS). We identified the lifestyle patterns in the health workers cohort study, by K-means cluster analysis, in order to classify the subjects into non-overlapping groups. We included the following variables in a dichotomous scale: rotation of working hours, work stress, depressive symptoms, smoking, alcohol consumption and sleep hours. Continuous variables were transformed into dichotomies, below or above the median: total physical activity, activities with low energy expenditure, as well as dietary variables (23 food groups). We analyzed the association between the lifestyle pattern and cardiovascular risk, by using linear regression models, one for the cardiovascular risk percentage, and other for the cardiovascular risk score. Additionally, we evaluated the multiplicative interaction between the lifestyle pattern with sex, age and BMI. **Results:** Compared with a Healthy lifestyle pattern, an Hedonic lifestyle pattern (high consumption of tobacco and alcohol, low level of physical activity, inadequate sleep hours, work stress and diet rich in refined carbohydrates and fat) showed a positive association with the cardiovascular risk, only in subjects older than 40 years. On the other hand, taking a Healthy pattern as a reference, the Mixed pattern was associated with a higher cardiovascular risk score in the group of 26-40 years (intermediate consumption of tobacco and alcohol, high level of physical activity, high sedentarism and a diet rich in animal foods). **Conclusions:** Lifestyle patterns were associated with cardiovascular risk in a cohort of Mexican adults. It is necessary to promote a Healthy lifestyle in this population considering not only diet and physical activity, but also psychosocial factors, which together may have an effect on cardiovascular outcomes, and therefore a high potential for prevention

Keywords:

Lifestyle patterns, Diet, Physical activity, Smoking, Alcohol consumption, Cluster analysis, Adults.

Introduction

The lifestyle is the set of attitudes and habits that characterize the way we live [1]. The relationship between lifestyle components (mostly modifiable), with health outcomes, such as cardiovascular diseases, is widely recognized [2]. It is known that having factors such as an inadequate diet [2-6], a low level of physical activity [7, 8], being sedentary [9, 10], insufficient or excessive sleep [11], smoking [12, 13] or excessive consumption of alcohol [14] increases the risk of developing cardiovascular diseases.

One of the traditional ways to determine the risk attributable to a given factor is to evaluate its association with the health outcome independently, that is, assuming that the rest of the factors remain unchanged. However, some studies have shown that factors tend to cluster [15, 16]. Therefore different lifestyles could be expected in different population groups [17]. To our knowledge, studies that document the concurrent presence of factors of different lifestyle components in Mexican individuals are scarce.

In Mexico, cardiovascular diseases are the second cause of death, in men and women [18]. In 2015, 25.5% of deaths occurred in the country due to cardiovascular diseases, which corresponds to 166,934 deaths [19]. It is estimated that most of the deaths occurred in 2016 from cardiovascular diseases are attributed to potentially modifiable behavioral risk factors, (67.87% of deaths due to coronary ischemic disease, 47.46% of deaths due to cerebrovascular diseases and 30.52% of deaths due to hypertensive heart disease) [20]. Among these behavioral factors are the body mass index, arterial hypertension, inadequate diet, alcohol and tobacco consumption, high blood cholesterol, hyperglycemia and low level of physical activity [20].

There are psychosocial factors that can modify the risk of developing coronary heart disease, such as anxiety and depression. It is thought that these factors can have effects through different ways: a) They can modify the behaviors related to health, b) They can cause acute or chronic physio-pathological changes directly, c) They can influence the access and type of the medical attention of the individual [21] .

In the literature, some meta-analysis have shown that depression and lack of social support are associated with an increased risk of developing CVD and increased mortality from this

cause [22, 23]. On the other hand, occupation involving a frequent shift rotation has also been associated with the presence of major vascular events (myocardial infarction, coronary events and ischemic cerebrovascular accident) [24]. It is assumed that it may be due to a disruption of the circadian rhythm, which could modify the endocrine and metabolic function of the organism, making the subjects that work under these conditions more vulnerable [24].

Previous studies have shown that in Mexico, there is a high prevalence of risk factors for cardiovascular diseases, for example, 72.5% of Mexican adults are overweight or obese [25]. Regarding diet, it has been reported that foods rich in saturated fat and / or added sugars contribute 16% of the total energy, while the consumption of fruits and vegetables and legumes is low (5.5% and 3.8%, respectively) [26]. It is also known that Mexico is the largest consumer of sugary drinks, which are the main source of sugar ingestion in the population [27]. On the other hand, between 2006 and 2012 there was an increase of 6 percentage points in the prevalence of physical inactivity in adults [28]. With respect to tobacco consumption, 20.1% of the Mexican adult population currently smokes [29]. According to the National Survey on Drug, Alcohol and Tobacco Consumption 2016-2017, alcohol consumption has increased in Mexican adults, in 2011 the prevalence of excessive alcohol consumption during the last year was 31.2%, this percentage increased to 37.4% in 2016. The estimated per capita consumption for 2016 was 4.9 liters of alcohol pure in this population group [30].

Although the situation of cardiovascular risk factors in the population is known, the potential combinations of these factors are not known, neither their effect on cardiovascular risk in mexican population. The objective of this study is to determine the lifestyle patterns in Mexican adults and their association with the cardiovascular risk score and its individual components.

Methods

A longitudinal analysis was performed in men and women adults of the Health Workers Cohort Study (HWCS). The details of the original study has been previously described in other publications [31].

The cohort was a prospective study design, and its baseline stage began in 2004-2006, with the objective of studying the association between lifestyle factors and the occurrence of

chronic diseases. The sample included workers from the Mexican Social Security Institute (IMSS), workers and their families from the National Institute of Public Health (INSP) and the Autonomous University of the Mexico State (UAEMex); who had a follow-up of 6 years. All participants signed an informed consent at the time of entering the original study, which was approved by the Ethics and Research Commissions of the participating institutions: the Mexican Social Security Institute (12CEI 09 006 14), the National Institute of Public Health (13CEI 17 007 36), and the Autonomous University of the Mexico State (1233008X0236).

For the purposes of this study, we used data from 1923 men and women adults from 18 to 59 years old, who participated in both stages: the enrollment (2004-2006) and the follow up (2010-2012). We eliminated from the analysis the subjects who did not have dietary information (n=149), those who had incomplete information in other lifestyle variables (n=990) and/or implausible dietary data in the areas of interest (n=75) according to procedures established by Ramirez et al (>3SD from the average) [32]. Thus, the final sample consisted of 709 individuals, of whom 70.0% were women and 30.0% were men.

We obtained information of habits (diet, physical activity, alcohol consumption, tobacco use, sleep hours) work conditions (rotation of working hours), psychosocial factors (work stress, presence of depressive symptoms) and sociodemographic aspects (gender, age, marital status and schooling) through standardized questionnaires. Details of each instrument have been described elsewhere [31].

Diet

Briefly, the dietary information was obtained through a semi-quantitative 116-item food frequency questionnaire, previously validated in Mexican adult population [33]. Consumption was reported for the last 12 months; the total energy consumed was calculated using food nutrient composition databases developed by the INSP [34]. Subsequently, 23 food groups were generated, according to their nutritional properties: potatoes, fresh fruits, oils and oilseeds, fresh vegetables, legumes, pastries, refined cereals, whole grains, fish and shellfish, high-fat dairy products, low-fat dairy products, fruit juices, corn tortillas, soda, poultry, processed meats, red meat, butter and margarine, cookies, eggs, sweets, high-fat Mexican dishes, unprocessed sweetened beverages.

Physical activity and sedentary activities

Physical activity was obtained through a questionnaire validated in Spanish, and adapted for the HWCS population in Mexico [35]. Participants reported the time spent in specific activities during work and leisure-time (including sedentary activities such play videogames, or watch TV). The questionnaire collected information about the frequency, time and intensity of activities performed during the day in the last year. We calculated the daily minutes dedicated to activities of low energy expenditure (sedentary), as well as minutes of total physical activity (not including sedentary activities) [31].

Alcohol consumption

Alcohol consumption was classified into 2 categories: low-moderate (≤1 drink/day in women and ≤2 drinks/day in men) and hard-binge (≥1 drinks/day in women and ≥2 in men, and/or those who had 5 or more drinks per episode for both sexes) [31, 36].

Tobacco use

Tobacco use was defined according the World Health Organization (WHO) in two categories: smokers (an adult who has smoked 100 cigarettes in his or her lifetime and/or who currently smokes cigarettes) and non-smokers [37].

Sleep hours

Sleep hours were calculated through a questionnaire of daily activities, which included a segment of sleeping time [31]. They were classified in two categories: adequate (6-8 h/day) and inadequate (<6 or> 9 h/day) [38].

Psychosocial factors

Depressive symptoms

Presence of depressive symptoms was identified through the CES-D (Center for Epidemiologic Studies, Depression Scale), which include 20 questions that measure three aspects: interpersonal affective relationships, activity level and somatization. The total score obtained was classified into 2 categories: yes (≥16 pts.) or no (<16 pts.) [39].

Work stress

Work stress was measured using a scale of four questions, which evaluated the perception of the environment and appreciation in their work. The total score was classified into 2 categories (yes/no) [40].

Work conditions

Rotation of working hours

To identify subjects with a fixed or variable work schedule, the work shift (morning, afternoon, evening, cumulative or variable) was classified in two categories: with rotation (subjects who reported having variability of working hours) and without rotation (who reported only one schedule).

Lifestyle patterns

We identified the lifestyle patterns in the **baseline stage** (2004-2006) of the Health Workers Cohort Study, by K-means cluster analysis, in order to classify the subjects into non-overlapping groups [41]. We included the following variables in a dichotomous scale: rotation of working hours, work stress, depressive symptoms, smoking, alcohol consumption and sleep hours. Continuous variables were transformed into dichotomies, below or above the median: total physical activity (median: 558.0 min/day), activities with low energy expenditure (median: 131.8 min/day), as well as dietary variables (low or high consumption of each 23 food groups, according to their percent contribution to total energy intake). We tested solutions for 2 to 5 clusters. (Aditional table 1).

Cardiovascular risk

The Framingham Coronary Heart Disease Risk scale was used [42, 43]. The scale measures the risk to 10 years and allows to identify candidates of high risk for each and every one of the initial atherosclerotic cardiovascular events. The risk prediction is gender-specific and takes into account age, smoking, blood pressure, HDL-cholesterol, total cholesterol, and the presence of diabetes. The final score of the scale results in a predicted risk percentage. For the purposes of this study, an adaptation of the scale proposed by D'Agostino, et al (2008) was constructed, in which the smoking-derived score was eliminated, in order to avoid

confusion bias in the results, since the lifestyle pattern includes smoking (exposure). Thus, the total score-adapted (without smoking) resulted in a percentage of risk, according to the cut-off points established by D'Agostino [44]. We measured the cardiovascular risk at the baseline and 6 years after.

Biochemical-clinical evaluation

Venous blood samples were taken from the antecubital vein after an 8-hour fast. Plasma glucose was measured using a colorimetric enzyme kit. The concentrations of serum triglycerides were analyzed by a colorimetric method after a lipase hydrolysis process. The HDL-c and LDL-c cholesterol were evaluated through the clearance method. Total cholesterol was measured by the enzymatic colorimetric method. All biochemical evaluations were performed on a Selectra XL instrument (Randox, MA USA) following the international procedures for each measurement [45]. The concentration of LDL-c was calculated using the Friedwald equation [46, 47]. Serum concentrations were considered elevated when they were: ≥100mg /dL for glucose, ≥150mg/dL for triglycerides, ≥200mg/dL for total cholesterol and ≥100mg/dL for LDL cholesterol. For HDL cholesterol, concentrations were considered low if they were <45mg / dL in men and <50mg/dL in women [48]. The blood pressure was measured by trained nurses, with a digital blood pressure monitor placed on the right arm. The participants remained seated during the measurement. The procedure was followed in accordance with the guidelines established for the technique. The blood pressure figures were classified as high when the systolic blood pressure was greater than 130mmHg (without medication) or> 120mmHg (treated with medications) [44].

Statistical analysis

We analyzed the association between the lifestyle pattern and cardiovascular risk, by using linear regression models, one for the cardiovascular risk percentage, and other for the cardiovascular risk score. We performed an unadjusted, and two adjusted models: (1) adjusting by age and sex, (2) adjusting by sex, age, BMI, marital status, and education. Additionally, we evaluated the multiplicative interaction between the lifestyle pattern with sex, age and BMI.

In order to see the separate effect of the lifestyle pattern on cardiovascular risk factors that integrated the cardiovascular risk scale, we performed linear regression models (unadjusted and adjusted) using each one of the following variables as response variable: total cholesterol, ldl-cholesterol, triglycerides, systolic and dyastolic blood pressure. The level of significance was set at 0.05 for most analysis, with exception of interactions for which we used a 0.1 level. All the analysis were performed with the STATA/IC®, version 12.1.

Results

A total of 709 men and women from the Health Workers Cohort Study were evaluated (70.0% women and 30.0% men). We found 3 lifestyle patterns: *Healthy* (34.0%), *Hedonic* (32.0%) and *Mixed* (34.0%) (Tables 1 and 2).

The *Healthy* pattern was characterized by having the lowest proportion of tobacco and alcohol consumers, a high level of total physical activity and the lowest proportion of subjects with inadequate sleep hours (Table 1). In addition, a high consumption of fruits, vegetables, whole grains, low-fat dairy products, fruit juices and low consumption of pastries, refined cereals, sodas, processed meat, red meat, butter, eggs, sweets and high-fat Mexican dishes was observed (Table 2).

Subjects with the *Hedonic* pattern had the highest percentage of tobacco and alcohol consumption, a low level of total physical activity, the least time devoted to sedentary activities, the highest percentage of subjects with inadequate sleep hours and the highest percentage of work stress (Table 1). There was also a high consumption of pastries, corn tortillas, sodas, an intermediate consumption of refined grains, animal foods, cookies, sweets, high-fat Mexican dishes and a low consumption of potatoes, fruits, oilseeds, vegetables, whole grains, fish and seafood, low fat milk, fruit juices and chicken (Table 2).

In the *Mixed* pattern, the subjects had an intermediate consumption of alcohol, a high consumption of tobacco, a high level of total physical activity, although it was also the pattern with the longest time devoted to sedentary activities (Table 1). As for the diet, a high consumption of oilseeds, refined cereals, fish and seafood, animal foods, sodas, cookies, sweets and Mexican high-fat dishes (Table 2).

Lifestyle patterns and cardiovascular risk

Regarding the cardiovascular risk in the sample, 4.4% of the subjects had a 10-year cardiovascular risk of 10% or greater in the basal stage, while in the final stage (6 years later), the proportion increased to 14.8% (Aditional table 2)

The hedonic pattern was positively associated with the cardiovascular risk percentage in the unadjusted model (β: 0.59, 95% CI: 0.05, 1.14, p=0.03), but this effect was not maintained after adjusting by sex, age, BMI, diabetes, education and marital status. None of the lifestyle patterns was associated with the initial cardiovascular risk score in unadjusted or adjusted models.

No association were found between the lifestyle patterns and the 10-year cardiovascular risk percentage in any of the models (unadjusted an adjusted) (Table 3). However, when evaluating the cardiovascular risk score, it was observed that the subjects who had the *Mixed* pattern at the beginning of the study had a higher cardiovascular risk score in the final stage (β: 0.59, 95% CI: 0.03, 1.14, p = 0.04) compared to the *Healthy* pattern, adjusting by sex and age. This effect was not maintained when adjusting also by BMI, marital status and educational level (β: 0.51, 95% CI: -0.03, 1.05, p = 0.06), however, although the significance is marginal, this suggests that the risk remains in those who had this pattern, that is, not all cardiovascular risk is explained by the adjusting variables (Table 4).

The interactions between the lifestyle pattern and sex and BMI were not significant. Regarding the interaction between age and lifestyle pattern, it was observed that the effect of the lifestyle pattern on cardiovascular risk is mediated by age. Having a *Hedonic* pattern at an older age increases cardiovascular risk, (β: 1.52, 95% CI -0.09, 3.13 in the group of 41-49 years and β: 4.71, 95% CI -0.21, 9.62 in the group of 51-59 years, p <0.1 for the interaction in both categories), compared to the *Healthy* pattern, adjusting by sex, age, and BMI.

In turn, the Mixed pattern increased the cardiovascular risk in the 26-40 years group (β: 1.21, 95% CI: 0.21, 2.20, p-interaction <0.1), in comparison with the *Healthy* pattern (Table 5). No interaction was found between lifestyle patterns and sex or BMI (data not shown).

When we analyzed the separate effect of the lifestyle pattern on the components of the cardiovascular risk scale (total colesterol, LDL-cholesterol, triglycerides, systolic and

diastolic blood pressure), we found that the subjects who had the *Mixed* pattern at the beginning of the study had a higher concentration of total and LDL-cholesterol 6 years later, compared with subjects with a *Healthy* pattern (adjusted for sex, age, BMI, marital status and education). In the case of triglycerides, subjects with the *Hedonic* pattern had higher concentration in the unadjusted model, however, this association was not maintained when adjusting for the confounding variables (Table 6).

Regarding systolic blood pressure, both the *Mixed* and the *Hedonic* patterns were associated with a higher levels of systolic pressure compared to the *Healthy* pattern (adjusting for sex and age). However, afer adjusting for BMI, marital status and education, that association was not significant. Finally, the diastolic blood pressure was higher in the *Hedonic* pattern compared to the *Healthy* pattern in the unadjusted and adjusted models (Table 6).

Discussion

This study evaluated the association between lifestyle patterns and cardiovascular risk in a cohort of Mexican adult health workers. Compared with a H*ealthy* lifestyle pattern, an H*edonic* lifestyle pattern (high consumption of tobacco and alcohol, low level of physical activity, inadequate sleep hours, work stress and diet rich in refined carbohydrates and fat) showed a positive association with the cardiovascular risk, only in subjects older than 40 years. On the other hand, taking a H*ealthy* pattern as a reference, the M*ixed* pattern was associated with a higher cardiovascular risk score in the group of 26-40 years (intermediate consumption of tobacco and alcohol, high level of physical activity, high sedentarism and a diet rich in animal foods).

The lack of association between the lifestyle patterns and the risk percentage in categories may be explained by the low proportion of subjects classified as10-year high risk according with the Framingham scale. The association between the *Hedonic* pattern and the cardiovascular risk score can be explained by the joint effect of its components (mostly related to negative effects on health). Smoking damages endothelial cells and increases arterial thrombogenesis, in addition to accelerating the generation of atherosclerotic plaque by increasing the oxidation of lipoproteins. On the other hand, the low level of physical activity decreases the energetic activation of the skeletal muscle, which can lead to metabolic alterations such as glucose intolerance, hyperinsulinemia and dyslipidemias. Similarly, lack

of sleep can alter glucose metabolism, endocrine function and energy intake [49-52]. In addition, the diet of this pattern was high in simple carbohydrates and a low consumption of foods rich in vitamins, minerals and fiber; which can enhance the effect of the other factors present in the pattern. Several studies have reported that a diet rich in simple carbohydrates and low consumption of fruits and vegetables is associated with an increased risk of health outcomes.

The *Hedonic* pattern was positively associated with the concentration of triglycerides in plasma, which may be due to the high consumption of alcohol in subjects with this pattern, but also to the consumption of foods rich in simple carbohydrates observed in this group [53]. The lifestyle patterns are not independent of the education level, that is why the loss of significance in the analysis can be explained by adjusting for this variable, that is, the risk is explained in part by education.

The effect of the lifestyle pattern is age-dependent, this indicates that although age is one of the main non-modifiable risk factors for developing cardiovascular diseases, having a hedonic pattern at 40 years old worsen the effect of age on the cardiovascular risk, compared with those who have a healthy pattern at the same age. Having a mixed pattern does not affect the youngest ones, however, in 26 years older persons the cardiovascular risk increases compared with a healthy pattern.

In the United States, Patterson, et al (1994) identified seven lifestyle patterns in adults (n = 5,484), of which, the so-called "hedonic" pattern (high consumption of alcohol and tobacco, moderate physical activity) is similar to the H*edonic* pattern observed in this study of Mexican health workers. However, Patterson's pattern had a good quality diet, while in our study, the diet of this pattern had a poor variety and a high consumption of refined carbohydrates and fats. On the other hand, Patterson found a "health promoting" pattern (good diet, high physical activity, low consumption of alcohol and tobacco) which coincides with our *Healthy* pattern [54].

In Holland, De Vries, et al (2008) evaluated 9, 449 people over 12 years of age, where they found three patterns: "Healthy", "Unhealthy" and "Poor diet". The "healthy" pattern (high probabilities of adhering to the norm for physical activity, and alcohol consumption, and moderate probabilities of adhering to the norm for smoking, and vegetable and fruit

consumption) is similar to the *Healthy* pattern found in our study, while the "unhealthy" pattern (low probabilities of adhering to the norm of physical activity, fruit and vegetable consumption, and moderate probabilities to fullfill the norm of alcohol and tobacco) shows similar characteristics to the *Hedonic* pattern of our study [55].

Alcohol consumption is an important issue in this population, since a high proportion of subjects with excessive intake (17.9%) was observed. The fact of being health workers could explain this behavior, since this type of work is related to high levels of stress. High stress level increases the concentration of glucocorticoids, which have an effect on the brain, specifically on the reward system (emotion, reward and decision making), enhancing the motivation to consume substances that produce pleasure or relaxation [21, 56].

It has been shown that alcohol abuse increases the risk of cardiovascular diseases. Whitman, et al (2017) demonstrated that in a cohort of adult residents of California, USA, who were admitted to the ambulatory surgery unit for incident diagnosis of atrial fibrillation (AF), myocardial infarction (MI) or congestive heart failure (CHF), alcohol abuse was positively associated with the three pathologies: AF (HR: 2.14; 95% CI: 2.08, 2.19; $p < 0.0001$), MI (HR: 1.45; 95% CI: 1.40, 1.51; $p < 0.0001$), and CHF (HR: 2.34; 95% CI: 2.29, 2.39; $p < 0.0001$)[14].

The association between excessive alcohol consumption and cardiovascular diseases can be attributed to the direct toxic effect of ethanol and its metabolites (acetaldehyde) on cardiac tissue, which produces an alteration in cellular processes, altering protein synthesis and accelerating apoptosis[57]. This affects the contractility of the heart muscle and generates ventricular fibrosis, which exacerbates the problem of cardiac contractility [57]. In addition, chronic alcohol consumption produces hypertriglyceridemia, because it affects the synthesis and degradation of lipoproteins, favoring their accumulation in the blood [58].

Importantly, the individuals with the H*edonic* pattern, not only had the lowest dietary quality and the highest tobacco and alcohol consumption, but also had the highest prevalence of depressive symptoms. Depression can modify behaviors and habits in those who suffer from it [59]. A depressed person perform less physical activity and have a diet of poor nutritional value (with high consumption of sugars and fats) [60]. Aditionally, it has been reported that subjects with high consumption of alcoholic beverages have higher risk of depresssion [61].

On the other hand, depression is an independent factor of cardiovascular diseases, since it decreases the concentration of brain-derived neurotrophic factor (BDNF), involved in the maintenance of endothelial cells [62]. This highlights the importance of considering psicosocial factors while studing the lifestyle patterns.

To prevent cardiovascular disease, it is known that changes in lifestyle, such as diet, physical activity, smoking and alcohol consumption must be promoted [2]. However, it is necessary to recognize that each person faces different barriers and limitations, some of which can not be controlled (age, poverty or disabilities). Therefore, prevention should not be based simply on diet and exercise, but should be considered all other aspects that affect cardiovascular health in different populations, as is the case of mental health [63]. The results of this study show that psicosocial factors are related with cardiovascular risk in Mexican adults. For example, in this population a high prevalence of work stress and depression was found, which were related to other cardiovascular risk behaviors such as high consumption of tobacco and alcohol (observed in the hedonic pattern). In order to modify the consumption of alcohol and tobacco, it is necessary to solve the problems of depression and stress that could be exacerbating these habits in this population [64]. It is fundamental to consider an integral prevention approach, including lifestyle factors (diet, physical activity, tobacco and alcohol consumption), but also the presence of other factors such as working conditions and psychosocial aspects that can be affecting other behaviors related to health. The integral approach will identify the barriers to achieving compliance with the recommendations and help define tailored strategies to different population groups, according to their needs [65].

This study had limitations, such as those inherent to the cluster analysis to determine the lifestyle patterns, this technique requires an a priori classification of the variables to be included in the analysis, in order to diminish the effect of the different scales of the variables on the results. This means that the variability of the population's data is not taken into account, forcing the subject to belong to a category. However, it is one of the most used techniques for data reduction due to its simplicity of interpretation. On the other hand, we could not measure the lifestyle patterns at the end of the study, which would give us more information about the changes that occur over time in the combinations of cardiovascular risk factors.

Despite the mentioned limitations, this study has several strengths, among them, it is a novel approach that allows to identify the natural grouping of cardiovascular risk factors in a population of Mexican adults, which, to our knowledge, has not been reported before. Also, the information was collected with standardized and validated instruments for the Mexican population. In addition, the sample size allowed us to observe a diversity of patterns, which were associated with a different cardiovascular risk at the end of the study.

In conclusion, lifestyle patterns were associated with cardiovascular risk in a cohort of Mexican adults. It is necessary to promote a healthy lifestyle in this population considering not only diet and physical activity, but also work conditions and psychosocial factors, which together may have an effect on cardiovascular outcomes, and therefore a high potential for prevention.

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Table 1. Distribution of components of lifestyle patterns (habits and psychosocial factors).

	LIFESTYLE PATTERNS (n=709)			
	Healthy	**Hedonic**	**Mixed**	
COMPONENTS	**%**	**%**	**%**	**P**
n (%)	241 (34.0)	227 (32.0)	241 (34.0)	
Alcohol consumption (Heavy-Binge)	8.7[a]	29.1[b]	16.6[c]	**<0.01**
Tobacco consumption (% smokers and ex smokers)	38.2[a]	54.6[b]	47.3[b]	**<0.01**
Total Physical activity (minutes/day)-quantile 2	59.8[a]	42.7[b]	56.9[a]	**<0.01**
Low energy expenditure activities-sedentary (minutes/day) – quantile 2	48.6[ab]	39.7[b]	56.0[a]	**<0.01**
Hours of sleep (inadequate: <6 or >9h/day)	7.5[a]	17.2[b]	10.8[a]	**<0.01**
Rotation of Working Hours (Yes)	9.3	10.7	15.3	0.12
Work stress (Yes)	64.3[a]	76.2[b]	61.4[a]	**<0.01**
Presence of Depressive Symptoms (Yes)	17.4	25.6	23.7	0.08

Comparison of means by Anova test of one way to 95% confidence, significance p <0.05. Comparison of proportions by chi-square test. Significance p <0.05. [abc.] Different letters per column indicate significant differences between the variables according to the lifestyle pattern

Table 2. Distribution of components of lifestyle patterns (dietary aspects).

n=709		Healthy	Hedonic	Mixed	
Food groups (% total energy)	**Median (p25-p75)**	**% subjects with high consumption (quantile 2)**			**P**
Potatoes	0.8 (0.4 - 1.7)	57.3[a]	29.1[b]	59.3[a]	**<0.01**
Fresh fruits	14.9 (8.3 - 25.0)	87.1[a]	29.1[b]	35.3[b]	**<0.01**
Oils and oilseeds	0.7 (0.4 - 1.2)	58.9[a]	24.7[b]	69.3[c]	**<0.01**
Fresh vegetables	3.9 (2.6 - 6.0)	75.5[a]	19.8[b]	51.0[c]	**<0.01**
Legumes	1.0 (0.6 - 1.7)	53.9	44.5	48.6	0.12
Pastries	3.6 (1.5 - 7.1)	31.5[a]	66.5[b]	51.0[c]	**<0.01**
Refined cereals	9.9 (6.6 - 14.1)	36.1[a]	50.2[b]	62.2[c]	**<0.01**
Whole grains	0.2 (0.1 - 0.9)	73.0[a]	18.5[b]	62.2[c]	**<0.01**
Fish and shellfish	1.6 (1.0 - 2.5)	53.9[a]	24.2[b]	71.0[c]	**<0.01**
High-fat dairy products	11.3 (6.6 - 17.6)	54.4	46.7	52.7	0.22
Low-fat dairy products	0.7 (0.1 - 4.0)	65.2[a]	40.1[b]	53.9[c]	**<0.01**
Fruit juices (unprocessed)	0.9 (0.3 - 2.7)	68.5[a]	33.0[b]	51.9[c]	**<0.01**
Corn tortillas	7.4 (2.6 - 12.5)	37.8[a]	79.3[b]	41.5[a]	**<0.01**
Sodas	1.6 (0.7 - 4.2)	22.0[a]	62.6[b]	64.7[b]	**<0.01**
Poultry	5.5 (2.6 - 8.2)	51.5[ab]	44.5[b]	59.8[a]	**<0.01**
Processed meats	2.1 (1.3 - 3.4)	22.0[a]	47.1[b]	79.3[c]	**<0.01**
Red meats	5.6 (3.5 - 8.8)	31.5[a]	45.8[b]	76.8[c]	**<0.01**
Butter and margarine	0.1 (0.0 - 0.1)	33.6[a]	47.6[b]	70.1[c]	**<0.01**
Cookies	0.9 (0.4 - 2.8)	36.1[a]	55.1[b]	67.2[c]	**<0.01**
Eggs	0.8 (0.3 - 1.7)	39.8[a]	54.2[b]	51.5[b]	**<0.01**
Sweets	1.4 (0.8 - 2.4)	27.8[a]	38.8[b]	83.0[c]	**<0.01**
High fat Mexican dishes	2.5 (1.6 - 4.0)	26.1[a]	50.2[b]	74.7[c]	**<0.01**
Unprocessed sweetened beverages	3.2 (1.0 - 8.6)	51	52	47.3	**0.56**

Comparison of means by Anova test of one way to 95% confidence, significance p <0.05. Comparison of proportions by chi-square test. Significance p <0.05. [abc.] Different letters per column indicate significant differences between the variables according to the lifestyle pattern

Table 3. Linear regression models for 10-year % cardiovascular risk after 6y follow-up in urban Mexican adults, 2010-2012

n=709	Model 1: crude			Model 2: adjusted by sex and age			Model 3: adjusted by sex, age and BMI			Model 3: adjusted by sex, age, BMI and education			Model 3: adjusted by sex, age, BMI, education and marital status		
Variables				**β**	**[95 %**	**CI]**	**β**	**[95 %**	**CI]**	**β**	**[95 %**	**CI]**	**β**	**[95 %**	**CI]**
Lifestyle pattern															
Healthy	Reference														
Mixed	0.60	-0.31	1.50	0.45	-0.23	1.13	0.40	-0.28	1.07	0.38	-0.30	1.07	0.40	-0.28	1.09
Hedonic	0.81	-0.14	1.75	0.14	-0.56	0.84	0.06	-0.65	0.77	0.01	-0.69	0.70	0.04	-0.66	0.73
Sex (men)				4.55*	3.78	5.32	4.35*	3.58	5.12	4.35*	3.58	5.12	4.39*	3.61	5.17
Age (years)				0.36*	0.32	0.40	0.34*	0.30	0.38	0.34*	0.30	0.38	0.34*	0.30	0.38
BMI															
Normal (<25)															
Overweight (≥25)							0.70*	0.13	1.27	0.69*	0.12	1.26	0.68*	0.10	1.25
Obesity (≥30)							1.53*	0.57	2.49	1.54*	0.57	2.50	1.54*	0.58	2.51
Education															
Basic (Elementary school)															
Mid-level (High-school)										-0.47	-1.54	0.60	-0.47	-1.54	0.60
High (Bachelor-graduate degree)										-0.46	-1.61	0.69	-0.46	-1.61	0.69
Marital status (with stable partner)													-0.14	-0.73	0.44

*significance p<0.05

Table 4. Linear regression models for cardiovascular risk score after 6y follow-up in urban Mexican adults, 2010-2012

n=709	Model 1: unadjusted			Model 2: adjusted by sex and age			Model 3: adjusted by sex, age and BMI			Model 3: adjusted by sex, age, BMI and education			Model 3: adjusted by sex, age, BMI, education and marital status		
Cardiovascular risk score (adapted)	**β**	**[95 %**	**CI]**	**β**	**[95 %**	**CI]**	**β**	**[95 %**	**CI]**	**β**	**[95 %**	**CI]**	**β**	**[95 %**	**CI]**
Lifestyle pattern															
Healthy	Reference														
Mixed	0.18	-0.67	1.03	0.59*	0.03	1.14	0.52	-0.02	1.07	0.49	-0.05	1.03	0.51	-0.03	1.05
Hedonic	0.06	-0.81	0.93	0.31	-0.23	0.85	0.22	-0.32	0.76	0.11	-0.43	0.64	0.12	-0.41	0.66
Sex (men)				2.30*	1.83	2.77	2.07*	1.60	2.54	2.07*	1.60	2.55	2.09*	1.60	2.57
Age (years)				0.45*	0.43	0.48	0.44*	0.41	0.46	0.43*	0.40	0.46	0.43*	0.40	0.46
BMI															
Normal (<25)															
Overweight (≥25)							0.86*	0.37	1.35	0.84*	0.35	1.32	0.81*	0.32	1.30
Obesity (≥30)							1.74*	1.07	2.41	1.74*	1.07	2.40	1.73*	1.06	2.40
Education															
Basic (Elementary school)															
Mid-level (High-school)										-0.79*	-1.55	-0.02	-0.79*	-1.55	-0.02
High (Bachelor-graduate degree)										-0.48	-1.32	0.35	-0.49	-1.33	0.35
Marital status (with stable partner)													0.01	-0.46	0.49

*significance p<0.05

Table 5. Interaction between age and lifestyle patterns on *10-year % cardiovascular risk* (2010-2012)

Cardiovascular risk % at follow-up	**β**	**95% CI**
Age groups		
18-25	-	-
26-40	0.27	-0.26, 0.80
41-49	4.13	3.32, 4.94*
50-59	6.49	4.57, 8.42*
Lifestyle pattern		
Healthy	-	-
Mixed	-0.79	-1.56, -0.02
Hedonic	-0.95	-1.84, -0.05*
Lifestyle pattern *Age		
Hedonic x 26-40years	0.12	-0.98, 1.23
Hedonic x 41-49years	1.52	-0.09, 3.13**
Hedonic x 51-59years	4.71	-0.21, 9.62**
Mixed x 26-40years	1.21	0.21, 2.20**
Mixed x 41-49years	1.19	-0.34, 2.72
Mixed x 51-59years	0.30	-3.05, 3.66
Sex (Men)	4.50	3.71, 5.30*
BMI (kg/m^2)	0.20	0.12, 0.28*

*significance p<0.05, **significance for interaction p<0.1

Table 6. Linear regression models for cardiovascular risk factors in urban Mexican adults, 2010-2012

n=709	Unadjusted Model		Adjusted Model 1: age and sex		Adjusted Model 2: age, sex, BMI, marital status and education	
Total colesterol (mg/dL)	**β**	**p**	**β**	**p**	**β**	**p**
Healthy lifestyle	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mixed lifestyle	5.63	0.12	7.57	0.03	8.36	0.02
Hedonic lifestyle	-0.41	0.91	1.86	0.64	3.78	0.38
Sex (male)	-	-	0.97	0.78	1.44	0.69
Age (years)	-	-	1.19	<0.01	1.22	<0.01
Marital status (with stable partner)	-	-	-	-	0.52	0.88
BMI (Kg/m^2)	-	-	-	-	-0.5	0.16
Education (Bachelor or graduate-degree)	-	-	-	-	3.22	0.31
LDL-cholesterol (mg/dL)						
Healthy lifestyle	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mixed lifestyle	5.48	0.07	6.9	0.02	7.41	0.02
Hedonic lifestyle	-1.78	0.56	-0.04	0.99	1.05	0.75
Sex (male)	-	-	0.17	0.95	1.44	0.62
Age (years)	-	-	0.83	<0.01	0.94	<0.01
Marital status (with stable partner)	-	-	-	-	-1.15	0.68
BMI (Kg/m^2)	-	-	-	-	-0.23	0.46
Education (Bachelor or graduate-degree)	-	-	-	-	1.04	0.69
Triglycerides (mg/dL)						
Healthy lifestyle	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mixed lifestyle	17.17	0.15	11.88	0.33	6.29	0.57
Hedonic lifestyle	42.41	<0.01	29.45	0.05	30.29	0.06
Sex (male)	-	-	59.78	<0.01	49.95	<0.01
Age (years)	-	-	2.76	<0.01	1.89	<0.01
Marital status (with stable partner)	-	-	-	-	7.4	0.42
BMI (Kg/m^2)	-	-	-	-	2.07	0.1
Education (Bachelor or graduate-degree)	-	-	-	-	8.91	0.4
Systolic blood pressure (mmHg)						
Healthy lifestyle	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mixed lifestyle	3.73	0.01	3.27	0.02	2.39	0.07
Hedonic lifestyle	4.59	<0.01	3.13	0.02	2.47	0.06
Sex (male)	-	-	8.29	<0.01	7.22	<0.01
Age (years)	-	-	0.54	<0.01	0.44	<0.01
Marital status (with stable partner)	-	-	-	-	0.81	<0.01
BMI (Kg/m^2)	-	-	-	-	-0.75	0.51
Education (Bachelor or graduate-degree)	-	-	-	-	-2.22	0.04
Diastolic blood pressure (mmHg)						

Healthy lifestyle	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mixed lifestyle	2.9	<0.01	2.35	0.01	1.58	0.08
Hedonic lifestyle	4.51	<0.01	3.16	<0.01	2.48	0.01
Sex (male)	-	-	6.19	<0.01	5.62	<0.01
Age (years)	-	-	0.28	<0.01	0.24	<0.01
Marital status (with stable partner)	-	-	-	-	-0.18	0.82
BMI (Kg/m^2)	-	-	-	-	0.39	<0.01
Education (Bachelor or graduate-degree)	-	-	-	-	-3.33	<0.01

Linear regression model, significance $p<0.05$.

Aditional table 1. Operationalization of variables included in the construction of lifestyle patterns.

Variable	Original unit	Final Scale	Classification
HABITS			
Diet	% energy	Dichotomic	23 food groups (% of total energy): dichotomized in 2 quantiles according the median of each food group. Quantile 1= Low consumption of each food group, Quantile 2= high consumption of each food group.
Alcohol consumption	Drinks/day	Dichotomic	Low-moderate: ≤1 drink/day in women and ≤2 drinks/day in men. Hard-Binge:≥1 drinks/day in women and ≥2 in men, and/or those who had 5 or more drinks per episode for both sexes.
Tobacco consumption	Cigarretes/day	Dichotomic	No: <100 cigarretes in lifetime or no-smokers. Yes: smoked 100 cigarettes in his or her lifetime and/or who currently smokes cigarettes
Total Physical activity	Min/day	Dichotomic	2 quantiles according the median (min/day): Quantile 1=low physical activity, Quantile 2= high physical activity
Low energy expenditure activities-sedentary	Min/day	Dichotomic	2 quantiles according the median: Quantile 1=low sedentary activities, Quantile 2= high sedentary activities
Hours of sleep	Hours/day	Dichotomic	Adequate: ≥6h or ≤9h. Inadequate: <6h or >9h
WORKING CONDITIONS			
Rotation of Working Hours	Categorical	Dichotomic	No: only one schedule, Yes: variability of working hours
PSYCHOSOCIAL FACTORS			
Work stress	Categorical	Dichotomic	Yes/No
Depressive Symptoms	Continuous	Dichotomic	Yes: ≥16 pts, No: <16pts.

Aditional table 2. Baseline characteristics of Mexican adults participants in the HCWS (2004-2006)

n=709	**n**	**%**
Sex		
Women	496	70.0
Men	213	30.0
Age (years)		39.1 ± 7.9
18-25	38	5.4
26-40	336	47.4
41-49	276	38.9
50-59	59	8.3
BMI		
Normal (<25)	308	43.4
Overweight (≥25)	284	40.1
Obesity (≥30)	117	16.5
Education		
Basic (Elementary school)	86	13.0
Mid-level (High-school)	167	25.2
High (Bachelor-graduate degree)	410	61.8
Marital status		
Without stable partner	253	35.7
With stable partner	455	64.3
Cardiovascular Risk Percentage (Mean ± SD)	709	3.5 ± 3.1
Cardiovascular Risk Score (Mean ± SD)	709	4.0 ± 4.0

SECCIÓN IV. Consideraciones finales y recomendaciones.

Existe una amplia evidencia científica de la asociación de factores de riesgo independientes sobre la salud cardiovascular. A pesar de ello, las enfermedades cardiovasculares son la principal causa de muerte en el país.

Este documento muestra que los individuos tienen distintas combinaciones de factores protectores y de riesgo cardiovascular, lo que puede modificar la estimación de riesgo final. La promoción de la salud cardiovascular debería estar diseñada de acuerdo con las características de la población objetivo. Es necesario reconocer la variedad de factores que intervienen y se interrelacionan para producir el desenlace de salud.

Si en una población existen diferentes patrones de estilo de vida con características particulares (por ejemplo, los sujetos con el patrón hedónico tuvieron una alta prevalencia de depresión y estrés laboral, además de hábitos inadecuados), es lógico pensar que una estrategia de intervención tradicional general (basada en dieta y actividad física), que no tome en cuenta los aspectos psicosociales, posiblemente no tenga el impacto esperado sobre el indicador de salud.

Es importante estudiar cómo se modifican los patrones de estilo de vida, a lo largo del tiempo, ya que los hábitos no son constantes. Esto permitirá conocer el efecto de las diferentes combinaciones de factores de riesgo en distintos momentos de la vida de un individuo, sobre el riesgo de desarrollar enfermedades crónicas.

Por lo anterior, se recomienda continuar con el estudio de los patrones de estilo de vida en la población Mexicana y en subpoblaciones específicas, como son los grupos con mayor marginación y vulnerabilidad social (quienes comúnmente son los más afectados por las enfermedades crónicas), con el fin de identificar los aspectos clave para el diseño de intervenciones en salud.

SECCIÓN V. Conclusiones.

En este estudio de adultos Mexicanos, trabajadores de la salud, se encontraron tres patrones de estilo de vida con diferentes combinaciones de hábitos y aspectos psicosociales (Saludable, Mixto y Hedónico). El patrón hedónico tuvo la combinación de hábitos y aspectos psicosociales más negativa, y se asoció con un mayor riesgo cardiovascular a los 6 años de seguimiento, en comparación con un patrón de estilo de vida saludable.

El estudio de los patrones de estilo de vida es una técnica novedosa, que permite observar cómo se agrupan los comportamientos relacionados con la salud de los individuos estudiados. Esto facilita la identificación de grupos poblacionales con mayor riesgo de desarrollar enfermedades crónicas, pero también representa una oportunidad para diseñar intervenciones en salud, con características específicas para los subgrupos poblacionales. Es necesario continuar estudiando los cambios que ocurren en los componentes del estilo de vida a través del tiempo, así como su impacto sobre desenlaces de salud.