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Talita Monsores Paixão

Sobrepeso e obesidade em imigrantes brasileiros em Massachusetts: panorama com base em dados hospitalares e revisão sistemática

Rio de Janeiro
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Tese apresentada ao Programa de Pós-graduação em Saúde Pública e Meio Ambiente, da Escola Nacional de Saúde Pública Sergio Arouca, na Fundação Oswaldo Cruz, como requisito parcial para obtenção do título de Doutor em Saúde Pública e Meio Ambiente.

Orientadora: Prof.ª Dra. Liliane Reis Teixeira.

Coorientador: Prof. Dr. Carlos Eduardo Gomes Siqueira.

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RESUMO

Os Estados Unidos é o principal destino dos imigrantes brasileiros e Massachusetts está entre os principais estados no país que mais os recebem. A busca por melhores condições de vida é o motivo mais importante da imigração brasileira. Situações como trabalho insalubre, hábitos e costumes diferentes podem prejudicar a saúde dos imigrantes e gerar doenças como obesidade, fator de risco para a síndrome metabólica. A síndrome é uma condição em crescimento em todo o mundo e tende a aumentar seguindo a epidemia de obesidade. O crescimento da síndrome e seus fatores de risco é descrito em latinos nos EUA, mas ainda não está claro para os imigrantes brasileiros, que frequentemente não são considerados ou avaliados separadamente nos estudos. Este estudo objetivou avaliar a tendência temporal do sobrepeso e obesidade em imigrantes brasileiros em Massachusetts, de 2009 a 2020. Foi composto por dois artigos: o primeiro foi uma revisão sistemática e meta-análise desenvolvida através da estratégia PICO, que objetivou identificar a prevalência da síndrome metabólica e seus fatores de risco em imigrantes latinos nos EUA e realizar meta-análise dessas prevalências. A revisão incluiu 60 estudos e a meta-análise 52. As prevalências conjuntas obtidas para a hipertensão, diabetes tipo 2, obesidade geral e obesidade abdominal foram, respectivamente, 28% (IC95 23%-33%), 17% (IC95 14%-20%), 37% (IC95 33%-40%) e 54% (IC95 48%-59%). Poucos estudos incluindo imigrantes da América do Sul foram identificados. Apenas dois estudos incluíram brasileiros. Destaca-se a necessidade de condução de estudos com esses imigrantes tendo e vista as diferenças culturais, alimentares e linguísticas observadas entre os países da América Latina. O segundo artigo foi uma análise ecológica de séries temporais que objetivou analisar a tendência do sobrepeso e obesidade em população de imigrantes brasileiros em Massachusetts, a partir de dados secundários de base hospitalar (2009-2020). A amostra foi composta por 128.206 registros de brasileiros de 18 a 60 anos. Foram realizadas análises de tendência utilizando modelos de regressão polinomial. A escolha dos modelos ocorreu pelo melhor coeficiente de determinação, significância estatística do modelo e análise dos resíduos. A média de idade foi 38,9 (dp=10,6) e 61% foram mulheres. As prevalências de sobrepeso e obesidade foram 38,4% e 25,4%, respectivamente. Foi observada tendência crescente de obesidade e decrescente de sobrepeso e eutrofia. Pouco se sabe a respeito da saúde de imigrantes brasileiros e este estudo contribui na construção deste conhecimento. As tendências observadas vão de acordo ao crescimento mundial da obesidade e indicam a necessidade de realização de pesquisas futuras a nível individual, onde fatores como a aculturação poderão ser investigados.

Palavras-chave: Sobrepeso. Obesidade. Síndrome Metabólica. Imigrantes.

ABSTRACT

The United States is the largest destination of Brazilian immigrants. Massachusetts is one of leading destinations in the U.S. The search for better standards of living is the most important reason for Brazilian immigration. Conditions such as unhealthy and unsafe work conditions and different habits and customs, can harm immigrants' health and generate chronic conditions such as obesity, which is risk factor for Metabolic Syndrome. The syndrome is a growing condition worldwide and tends to increase following the obesity epidemic. The growth of the syndrome and its risk factors are described for Latinos in the U.S., but are still not clear for Brazilian immigrants, who are often not considered or evaluated separately in studies. This study aimed to evaluate the temporal trend of overweight and obesity in Brazilian immigrants in Massachusetts from 2009 to 2020. It was composed of two articles: the first was a systematic review and meta-analysis developed through the PICO strategy, which aimed to identify the prevalence of metabolic syndrome and its risk factors in U.S. Latino immigrants and to conduct a meta-analysis of that prevalence. The review included 60 studies and the meta-analysis 52. The pooled prevalence rates obtained for hypertension, type 2 diabetes, general obesity and abdominal obesity were 28% (95CI 23%-33%), 17% (95CI 14%-20%), 37% (95CI 33%-40%) and 54% (95CI 48%-59%), respectively. Few studies including immigrants from South America were identified. Only two studies included Brazilians. There is a need to conduct studies with these immigrants due to the cultural, dietary, and linguistic differences observed among Latin American countries. The second article was an ecological time series analysis that aimed to analyze the trend of overweight and obesity in the Brazilian immigrant population in Massachusetts, based on secondary hospital-based data (2009-2020). The sample consisted of 128,206 records of Brazilians aged 18 to 60 years. Trend analyses were performed using polynomial regression models. The choice of models was made based on the best determination coefficient, statistical significance of the model, and residual analysis. The mean age was 38.9 (sd=10.6) and 61% were women. The prevalence of overweight and obesity were 38.4% and 25.4%, respectively. An increasing trend of obesity and decreasing trends of overweight and eutrophy were observed. Since little is known about the health of Brazilian immigrants, this study contributes to the development of knowledge on Brazilian immigrant health. The observed trends confirm the worldwide increase in obesity and indicate the need for future research at the individual level, where factors such as acculturation can be investigated.

Keywords: Overweight. Obesity. Metabolic Syndrome. Immigrants.

SUMÁRIO

1 INTRODUÇÃO

O fenômeno migratório não é recente sendo a busca por melhores condições de vida seu principal impulsionador desde a antiguidade. A emigração de brasileiros para países desenvolvidos vem se destacando ao longo dos anos e os Estados Unidos (EUA) é o país que mais os recebe (PATARRA, 2005; SIQUEIRA, 2018b).

O estado de Massachusetts é o segundo principal destino dos imigrantes brasileiros nos EUA segundo dados do American Community Survey (ACS) de 2019 (US CENSUS BUREAU, 2019a), estando atrás apenas da Flórida e seguido pela Califórnia, Nova Jersey, Nova York e Connecticut.

O trabalho é um dos principais motivos que levam o indivíduo a deixar seu país de origem, contudo, grande parte dos imigrantes se insere no mercado informal de trabalho, submetendo-se a condições insalubres, sem contratos de trabalho e benefícios de cuidados a saúde, com baixos salários e extensas jornadas de trabalho. Essa situação pode gerar prejuízos à saúde do imigrante, sendo as condições crônicas de saúde como a obesidade, o diabetes e a hipertensão amplamente observadas nessa população (LIMA; SIQUEIRA, 2007; BALDWIN et al., 2010; SIQUEIRA; JANSEN, 2012; DUARTE; ESCRIVÃO JUNIOR; SIQUEIRA, 2013; SIQUEIRA; ROCHE, 2013).

Essas condições junto a outras características como a elevação dos triglicerídeos, da pressão arterial e a redução do colesterol HDL definem a síndrome metabólica (SM) (NCEP, 2002; GRUNDY et al., 2005; STABELINI NETO et al., 2012; KHOO; OLIVEIRA; CHENG, 2013), que é considerada um desafio mundial para a saúde pública, com prevalência variando de 20 a 40% e tendendo a aumentar seguindo a epidemia de obesidade (ZIMMET et al., 2005; MARCARINI; MENDES, 2013; MAURY; HONG; BASS, 2014; XU et al., 2015).

Estudos demonstram um crescimento alarmante da obesidade e de outros fatores de risco da SM nos EUA, em especial em populações de imigrantes latinos (BELTRÁN-SÁNCHEZ et al., 2016; GILL et al., 2017; HUBERT; SNIDER; WINKLEBY, 2005; NELSON et al., 2007). Todavia, esse crescimento em conjunto da obesidade e da SM não é exclusividade dos EUA, sendo observado cada vez mais em países em desenvolvimento, como consequência do processo de transição nutricional sofrido pela população (DELAVARI et al., 2013; KHOO; OLIVEIRA; CHENG, 2013; OZA-FRANK; CUNNINGHAM, 2010).

A obesidade é considerada pela Organização Mundial da Saúde uma epidemia global e pelo Ministério da Saúde um problema crescente de saúde pública evidenciado pelos dados do Vigitel Brasil na última década (BRASIL, 2022).

A alta prevalência do sobrepeso e da obesidade em imigrantes latinos nos EUA, bem como o alto risco de diabetes e de fatores de risco cardiometabólicos, são relacionados na literatura especialmente ao número de gerações do imigrante e ao tempo de residência no país, ao nível de aculturação e ao país de origem do imigrante (AFABLE-MUNSUZ et al., 2014; BARCENAS et al., 2007; CHOI, 2012; COMMODORE-MENSAH et al., 2018; GOEL, 2004), sendo crescente a condução de pesquisas que buscam investigar essas condições de saúde nessa população.

Ainda, impulsionados pela epidemia mundial da obesidade, estudos vêm sendo realizados objetivando a compreensão do complexo mecanismo fisiológico envolvido no desenvolvimento da obesidade e na regulação da massa corporal, com os hormônios reguladores do apetite sendo consideravelmente estudados (SCHWARTZ; MORTON, 2002; BLOOM et al., 2008). Nesse processo, a diminuição da leptina e o aumento da grelina ocorrem em conjunto para que haja o estímulo do apetite, mas esse estado pode contribuir para o desenvolvimento da obesidade se for mantido cronicamente (MARQUEZE; ULHÔA; CASTRO MORENO, 2014). Assim, modificações no ciclo vigília-sono, dessincronização circadiana e distúrbios do sono, bem como os fatores que favoreçam essas modificações como o trabalho em turnos e as jornadas irregulares de trabalho, estão sendo amplamente estudadas (TSCHÖP et al., 2001; SHEA et al., 2005; ATKINSON et al., 2008; SCHEER et al., 2009; MARQUEZE; ULHÔA; CASTRO MORENO, 2014; KETCHUM; MORTON, 2007; BELTRÃO; PENA, 2013; IFTIKHAR et al., 2015)

As evidências levantadas até o momento sugerem a importância da condução de estudos sobre as condições crônicas de saúde em populações imigrantes nos EUA. Todavia, estudos com essa finalidade que incluem brasileiros em sua amostra, ou analisam os dados com estratificação por etnia, ainda são escassos (BELTRÁN-SÁNCHEZ et al., 2016; GILL et al., 2017; CHAKRABORTY et al., 2003; HUBERT; SNIDER; WINKLEBY, 2005; JACKSON et al., 2014; TEHRANIFAR et al., 2015), e as discussões acerca da emigração de brasileiros para os países desenvolvidos são consideradas importantes em produções científicas e discussões políticas (PATARRA, 2005), o que demonstra a necessidade da condução de estudos direcionados à essa população.

2 REFERENCIAL TEÓRICO

2.1 PROCESSO MIGRATÓRIO

A emigração de brasileiros para países desenvolvidos vem se destacando de forma crescente desde que se tornou evidente, sendo um tema considerado importante em produções científicas e discussões políticas (PATARRA, 2005).

O fenômeno migratório, seja em âmbito nacional ou internacional, não é recente. Tendências migratórias podem ser observadas desde a antiguidade, onde há cerca de 2,5 milhões de anos os humanos já se deslocavam de um ambiente para outro buscando, principalmente, melhores condições alimentares, de abrigo e de segurança para si e para sua comunidade (SIQUEIRA, 2018b).

Segundo León (2005), as migrações podem ser definidas como deslocamentos ou mudanças de residência que ocorrem a certa distância devendo esta ser significativa e, também, deve ter caráter permanente ou com desejo de permanência. Este autor acrescenta ainda que o processo migratório é complexo, envolve diferentes subprocessos e acomete tanto o indivíduo como o coletivo.

Os EUA é o país que mais recebe brasileiros desde o início do movimento emigratório brasileiro (PATARRA, 2005; SIQUEIRA, 2018b). De acordo com Lazar-Neto e cols. (2018), entre os anos de 2010 e 2014 foi estimado que um total de 41 milhões de imigrantes residiam nos EUA, representando aproximadamente 13% da população total. Desses, 52% apresentavam origem hispânica ou latina. Segundo dados do American Community Survey (US CENSUS BUREAU, 2019a), os brasileiros representavam 455.738 imigrantes nos EUA em 2019.

Estudos anteriores concentrados nos movimentos migratórios de brasileiros demonstraram maior emigração de residentes de Governador Valadares e Criciúma para os EUA (ASSIS, 2007; FUSCO, 2005; SIQUEIRA; JANSEN, 2012) e, destacaram que a maioria dos imigrantes brasileiros provenientes destas duas cidades estava concentrada em Massachusetts (51,86% de Governador Valadares em 1997 e 83,08% de Criciúma em 2001), sendo Boston a principal cidade a receber esses imigrantes (37,60% de Governador Valadares em 1997 e 58,90% de Criciúma em 2001).

O estado de Massachusetts é um dos principais destinos dos imigrantes brasileiros nos Estados Unidos, junto com a Flórida, Nova Jersey, Nova York, Califórnia e Connecticut (LIMA;

SIQUEIRA, 2007; SIQUEIRA, 2011; SIQUEIRA; ROCHE, 2013; LAZAR-NETO et al., 2018; US CENSUS BUREAU, 2019a). Segundo o American Community Survey de 2019 (US CENSUS BUREAU, 2019b) a estimativa era de que o estado de Massachusetts apresentava a segunda maior população de imigrantes brasileiros nos EUA, com 92.957 pessoas, em especial na região metropolitana de Boston – *Metro Boston Region*. Entretanto, é possível que exista uma subestimação desses valores devido a condição indocumentada de alguns imigrantes, bem como a declaração incorreta da etnia brasileira nas categorias predefinidas do censo dos Estados Unidos (MARCELLI et al., 2009).

Segundo o censo estadunidense (US CENSUS BUREAU, 2022), a população latina é considerada toda aquela que possui cultura ou origem da América Latina, apresentando em suas classificações predefinidas de etnia as origens Cubana, Mexicana, Porto Riquenha e dos demais países das Américas Central e do Sul classificados como "outros com origem hispânica, latina ou espanhola".

Ao serem questionados sobre o motivo de escolherem a região metropolitana de Boston como destino nos EUA (MARCELLI et al., 2009), imigrantes brasileiros destacaram o trabalho entre as principais motivações; contudo, a maior concentração geográfica de brasileiros nessa região se mostrou um fator mais importante no momento da tomada de decisão.

A maioria dos imigrantes brasileiros que chegam nos EUA são jovens que se inserem no mercado informal de trabalho, sendo o trabalho, mesmo que em um cargo secundário e que não atinja suas qualificações (DUARTE; ESCRIVÃO JUNIOR; SIQUEIRA, 2013), um dos principais impulsionadores do processo migratório (LIMA; SIQUEIRA, 2007; MARCELLI et al., 2009; SIQUEIRA; JANSEN, 2012; DUARTE; ESCRIVÃO JUNIOR; SIQUEIRA, 2013; SIQUEIRA; ROCHE, 2013).

Segundo Mendes (2013), o trabalho é considerado fonte de prazer, satisfação e sustento para o indivíduo, contudo, dependendo da forma que ele é organizado (estrutura da realização da atividade) e executado, pode ser prejudicial para à saúde. Sendo assim, ao se estudar o trabalhador é necessário analisar o trabalho como um todo, em sua conjuntura de real e prescrito, e considerar as modificações que ocorrem durante o processo de trabalho (transformação do objeto e de quem o faz).

O trabalho informal segundo a Organização Internacional do Trabalho (OIT) (INTERNATIONAL LABOUR OFFICE, 2013) é definido como todo acordo empregatício que não

proporcione proteção legal ou social ao trabalhador através do trabalho, o expondo ao maior risco econômico. Condições de trabalho irregulares, instáveis, temporárias ou precárias são reconhecidas como trabalho informal e, grande parte dos imigrantes se submetem a trabalhos informais em especial em países desenvolvidos da Europa e nos EUA, estando o setor de trabalho temporário entre um dos que cresce mais rápido desde 2008 nos EUA (SIQUEIRA, 2016).

Além dos fatores econômicos e da falta de trabalho, o desejo de estar próximo aos familiares e amigos, a violência, o terrorismo, a insegurança, o turismo e a busca pelo bem-estar biopsicossocial também se mostram como fatores que impulsionam as migrações (MARCELLI et al., 2009). Para alguns autores, a globalização e a reestruturação da economia são apontadas entre os principais fatores para a intensificação do processo migratório, uma vez que com a globalização ocorre o aumento do fluxo de informações relacionadas aos padrões de vida e as oportunidades presentes nos países desenvolvidos (LEÓN, 2005; PATARRA, 2005, 2006). Baeninger (2013) destaca que as migrações internacionais no século XXI são integrantes do desenvolvimento e, importantes para o cotidiano social, o mercado de trabalho, o fluxo financeiro e a mobilidade da força de trabalho.

Apesar de serem uma das maiores comunidades de imigrantes nos Estados Unidos (MARCELLI et al., 2009), condições de saúde dos imigrantes brasileiros ainda são pouco estudadas. Grande parte dos estudos realizados com populações de imigrantes latinos nos EUA, que investigam condições crônicas de saúde (BELTRÁN-SÁNCHEZ et al., 2016; GILL et al., 2017; CHAKRABORTY et al., 2003; HUBERT; SNIDER; WINKLEBY, 2005; JACKSON et al., 2014; TEHRANIFAR et al., 2015), parecem não incluir ou não analisar separadamente os brasileiros, o que pode ser consequência da declaração/classificação incorreta da etnia desses imigrantes nas estatísticas oficiais estadunidenses. Analisar os brasileiros separadamente de outros imigrantes latinos é essencial devido as várias diferenças culturais, alimentares e linguísticas existentes entre os países da América Latina.

Quanto às ocupações, aquelas que mais empregam os imigrantes são as do setor alimentício, hospedagem, trabalho doméstico e construção civil (DUARTE; ESCRIVÃO JUNIOR; SIQUEIRA, 2013; SIQUEIRA, 2018a). Siqueira (2016) destaca que grande parte desses imigrantes exercem seu ofício em condições insalubres, sem contratos de trabalho e benefícios de cuidados a saúde, com baixos salários e extensas jornadas de trabalho, podendo esta jornada atingir 19 horas diárias de trabalho devido à existência de dois ou três empregos (DUARTE; ESCRIVÃO JUNIOR;

SIQUEIRA, 2013).

As jornadas irregulares de trabalho, bem como o trabalho em turnos, são cada vez mais comuns em uma sociedade com produção de bens e prestação de serviços que funcionam ininterruptamente (durante 24 horas diárias, por sete dias da semana), principalmente em grandes centros urbanos, sendo rotulada de “Sociedade 24 horas”. Sendo assim, o dia útil pode começar no início da manhã e continuar até tarde da noite para alguns trabalhadores (FISCHER, 2004; LINDHOLM et al., 2012; FISCHER; MORENO; ROTENBERG, 2013).

Segundo Fischer (2004), as longas jornadas de trabalho ininterruptas ou com poucos momentos de folga prejudicam a recuperação física e mental após o trabalho, o que propicia o desenvolvimento de problemas relacionados à saúde, entre eles os distúrbios gastrintestinais, alteração dos hábitos alimentares, diminuição da atenção e velocidade de reação, fadiga, distúrbios do sono, problemas cardiovasculares, síndrome metabólica, obesidade e câncer (LINDHOLM et al., 2012; MARQUEZE; ULHÔA; CASTRO MORENO, 2014). Evidências indicam que os imigrantes brasileiros podem estar sujeitos à diferentes riscos relacionados ao trabalho, em especial no que diz respeito aos fatores psicossociais, propiciando o desenvolvimento de problemas de saúde (SIQUEIRA; JANSEN, 2012). Assim, esta população se torna um importante foco de ação para a saúde pública e saúde do trabalhador.

Outras condições que também se mostram como agravantes a saúde desses imigrantes segundo alguns autores (FOOTRACER, 2009; DUARTE; ESCRIVÃO JUNIOR; SIQUEIRA, 2013; LAZAR-NETO et al., 2018), são o fato de muitos não serem documentados (evitam procurar serviços de saúde por medo de serem notados), a falta de seguro saúde, a baixa escolaridade e o maior índice de pobreza, além de alguns fatores que funcionam como estressores, como as barreiras linguísticas, a existência de sistemas legais e administrativos diferentes, os costumes, a alimentação, a cultura, a falta de redes sociais e comunitárias e o afastamento da família e amigos.

2.2 SÍNDROME METABÓLICA E OBESIDADE

A síndrome metabólica pode ser definida como um grupo de características clínicas que incluem a obesidade (geral e abdominal), a hiperglicemia, a resistência à insulina, a hipertrigliceridemia, o aumento da pressão arterial e a redução dos níveis de colesterol HDL (*high density lipoprotein*) (STABELINI NETO et al., 2012; BELTRÁN-SÁNCHEZ et al., 2013; KHOO; OLIVEIRA; CHENG, 2013; MARCARINI; MENDES, 2013; MAURY; HONG; BASS, 2014;

BAFFI et al., 2016; WHO, 1999). É utilizada na identificação do maior risco de doenças cardiovasculares (DCV), diabetes mellitus tipo 2 (DM2) e mortalidade por todas as causas (BELTRÁN-SÁNCHEZ et al., 2013; CANUTO; GARCEZ; OLINTO, 2013; XU et al., 2015), aumentando em cerca de 1,5 vezes o risco da mortalidade geral e em 2,5 vezes o risco da mortalidade por causas cardiovasculares, quando associada às DCV (MARCARINI; MENDES, 2013).

Weiss, Bremer e Lustig (2013) acrescentam que a SM se associa a muitas outras condições além da DCV e do DM2, estando entre estas a inflamação crônica de baixo grau, o estresse oxidativo, a hiperuricemia, o hiperandrogenismo, a síndrome do ovário policístico, a esteatose hepática e a doença hepática gordurosa não alcoólica, ao hipogonadismo, a demência vascular, ao aumento do peso corporal e aos distúrbios do sono. Os autores (WEISS; BREMER; LUSTIG, 2013) ressaltam, ainda, que nos EUA essas doenças constituem a maioria dos gastos com cuidados a saúde e representam uma ameaça maior ao mundo em desenvolvimento do que as doenças infecciosas agudas.

A descrição sistemática da SM foi realizada pela primeira vez por Reaven (1988), que destacou o papel da resistência à insulina em doenças humanas e a inter-relação entre a resistência à insulina, a hipertensão, o DM2 e a DCV, adotando o termo Síndrome X para descrever essa inter-relação (WEISS; BREMER; LUSTIG, 2013).

O National Cholesterol Education Program (NCEP, 2002) realizou a primeira definição padronizada da SM, que foi atualizada em 2005 por Grundy e cols. (2005), sendo estabelecidos como critérios diagnósticos para a síndrome a coexistência de três ou mais dos seguintes fatores:

- Circunferência abdominal elevada (≥102cm em homens e ≥88cm em mulheres) ou IMC ≥ 30kg/m² (WHO, 1999);
- Triglicerídeos elevados (≥150mg/dL ou 1,7mmol/L) ou tratamento para triglicerídeos elevados;
- Colesterol HDL reduzido (<40mg/dL ou 1,03mmol/L em homens e <50mg/dL ou 1,3mmol/L em mulheres) ou tratamento para colesterol HDL reduzido;
- Pressão arterial elevada (sistólica ≥130 mm/Hg e diastólica ≥85mm/Hg) ou tratamento de hipertensão arterial sistêmica;
- Glicemia de jejum elevada (≥100mg/dL) ou tratamento de diabetes mellitus.

Segundo a literatura, a SM se tornou um desafio mundial para a saúde pública. A prevalência da síndrome em todo o mundo varia de 20 a 40% e tende a aumentar seguindo a epidemia de obesidade, cuja prevalência está crescendo em vários países, especialmente os desenvolvidos (ZIMMET et al., 2005; MARCARINI; MENDES, 2013; MAURY; HONG; BASS, 2014; XU et al., 2015). Nos Estados Unidos, a prevalência de SM é de mais de 25% para a população adulta, e afeta cerca de 60% dos indivíduos com obesidade (WEISS; BREMER; LUSTIG, 2013; BAFFI et al., 2016).

Em estudo realizado com dados do período de 1999 a 2010 nos EUA, Beltrán-Sánchez e cols. (2013) observaram redução da prevalência de SM ao longo do tempo, contudo, observaram também modificações em seus componentes, como a tendência ascendente da obesidade abdominal na população, o aumento da resistência à insulina e a redução dos triglicerídeos que está provavelmente relacionada ao aumento do uso de estatinas e demais agentes modificadores de lipídios.

Na Pesquisa Nacional de Avaliação de Saúde e Nutrição (NHANES) realizada no período de 2003 a 2006 nos EUA, uma forte associação da SM com a idade foi observada, sendo a síndrome mais prevalente em indivíduos com maiores idades, além da maior prevalência em homens até os 59 anos (nos grupos acima de 60 anos a prevalência foi maior entre as mulheres), e da maior prevalência em indivíduos com alto índice de massa corporal (KHOO; OLIVEIRA; CHENG, 2013).

A obesidade é considerada um dos principais fatores de risco para o desenvolvimento da SM, juntamente a hipertensão, ao diabetes e a dislipidemia (HRUBY; HU, 2015; ZIMMET et al., 2005). Em 2020, um estudo conduzido com adultos nos EUA (SHI; WANG; NATARAJAN, 2020) destacou a associação importante entre a obesidade e a SM, ao identificar prevalência de SM de 61,6% em adultos com obesidade, de 33,2% naqueles com sobrepeso e de 8,6% em eutróficos.

Nos últimos anos, após cerca de 30 anos de crescimento constante da obesidade nos EUA, estudos indicam uma estabilidade na prevalência em torno de 35%. Entretanto, em populações minoritárias, como os latinos e os negros não latinos, o crescimento da obesidade continua alarmante (HRUBY; HU, 2015; MALIK; WILLETT; HU, 2013), bem como o crescimento da hipertensão, do diabetes e do colesterol elevado (CDC, 2021).

Em estudos com populações latinas nos EUA, prevalências elevadas dos fatores de risco relacionados a SM são observadas (AHMED et al., 2009; BELTRÁN-SÁNCHEZ et al., 2016; HUBERT; SNIDER; WINKLEBY, 2005). Delavari e cols. (2013) e Oza-Frank e Cunningham, (2010) identificaram em suas revisões sistemáticas aumento da obesidade em latinos. Nesses

estudos, estão entre os fatores que se relacionaram com o aumento do peso corporal os maiores níveis de aculturação do imigrante, o maior tempo de residência nos EUA, a geração do imigrante e o país de nascimento.

A modificação nos hábitos alimentares e na prática de atividades físicas pela exposição a um ambiente obesogênico como os EUA, também se mostram como fatores importantes para o aumento da obesidade e das doenças que compõem a SM em populações imigrantes (DELAVARI et al., 2013; OZA-FRANK; CUNNINGHAM, 2010).

O aumento em conjunto da prevalência da SM e da obesidade não é um fenômeno que vem ocorrendo somente nos EUA. Em países em desenvolvimento, aumentos importantes desses fatores são observados, em consequência, especialmente, da transição nutricional que esses países vem sofrendo nos últimos anos, que favorece o aumento do consumo de alimentos com baixo teor nutricional e calóricos, bem como a redução ou modificação na prática de atividades físicas (DELAVARI et al., 2013; KHOO; OLIVEIRA; CHENG, 2013; OZA-FRANK; CUNNINGHAM, 2010).

No Brasil, segundo dados do Ministério da Saúde (MS) (BRASIL, 2021), em 2020 o total de indivíduos acima do peso foi de 57,5% e de obesos foi de 21,5%. Em 2010 (BRASIL, 2011), o levantamento apontou um total de 48,1% de indivíduos acima do peso e 15% obesos, enquanto que em 2015 (BRASIL, 2017), a pesquisa do MS revelou o total de 53,9% de indivíduos acima do peso no país e 18,9% obesos, indicando o aumento do sobrepeso e da obesidade no país na última década.

O aumento do sobrepeso e em especial da obesidade observado em diferentes países é um fato preocupante, considerado pelo Ministério da Saúde um problema crescente de saúde pública e pela Organização Mundial de Saúde (OMS) uma epidemia global (DAMASO, 2003; BRASIL, 2017). Sendo assim, impulsionados pela epidemia mundial da obesidade, estudos acerca da compreensão do complexo mecanismo fisiológico implicado na regulação da massa corporal vêm sendo realizados, estando os hormônios reguladores do apetite, particularmente a grelina, leptina, e a insulina, sendo consideravelmente estudados visando a melhor compreensão da fisiopatologia da obesidade, visto que esses hormônios, por meio de sinais estimulatórios e inibitórios enviados ao sistema nervoso central, especificamente no hipotálamo, são elementos essenciais no controle do apetite e do comportamento alimentar (SCHWARTZ; MORTON, 2002; BLOOM et al., 2008).

A leptina foi descoberta em 1994 pelo laboratório do cientista Jeffrey Friedman e é um

peptídeo com 167 aminoácidos, sintetizada prioritariamente no tecido adiposo, com secreção pulsátil (média de 32 pulsos/dia) e circadiana, e apresenta como principal função a homeostase metabólica, sinalizando o estado nutricional para o sistema nervoso central e para os órgãos periféricos, o que leva à inibição do apetite e promoção da saciedade, com consequente limitação da ingestão alimentar. Seus níveis circulantes são proporcionais ao percentual de massa gorda corporal (ROHNER-JEANRENAUD; JEANRENAUD, 1996; LICINIO et al., 1997, 1998; LANGENBERG et al., 2005; KLOK; JAKOBSDOTTIR; DRENT, 2007; COOPER et al., 2018).

A grelina foi descoberta em 1999 por Kojima e cols. (1999) e é um peptídeo de 28 aminoácidos, sintetizada principalmente pelo estômago e pelo pâncreas, com ritmo circadiano e pico antes das refeições, sendo um regulador endógeno da homeostase energética e tendo a estimulação do apetite como uma de suas funções. Este peptídeo se apresenta de duas formas: grelina acilada e não acilada. A grelina não acilada, embora em maiores quantidades no soro humano do que a acilada, não possui ação no sistema endócrino, sendo a grelina acilada mais ativa. Suas concentrações séricas apresentam flutuações ao longo do dia de acordo com a ingestão de alimentos (DATE et al., 2000; WREN et al., 2001; TSCHÖP et al., 2001; VAN DER LELY et al., 2004; MUNDINGER; CUMMINGS; TABORSKY, 2006; KLOK; JAKOBSDOTTIR; DRENT, 2007; COOPER et al., 2018).

A insulina é um polipeptídeo relacionado ao controle do metabolismo dos hidratos de carbono, metabolizada por quase todos os tecidos, contudo com maioria degradada pelo fígado e rins. É sintetizada pelas células beta das ilhotas de Langerhans, sendo a glicose o sinal fisiológico mais importante para o estímulo de sua secreção que também apresenta ritmo circadiano. Em condições normais, a concentração de insulina é maior durante o dia e menor no período da noite, apresentando pico próximo ao horário de despertar, contudo, o número de refeições diárias pode modificar as suas concentrações (BODEN et al., 1996; JENKINS, 1997; SAPIN et al., 2001; AL-NAIMI et al., 2004).

Segundo Marqueze, Ulhôa e Castro Moreno (2014), a diminuição da leptina e o aumento da grelina ocorrem em conjunto para que haja o estímulo do apetite, entretanto, esse estado pode contribuir para o desenvolvimento da obesidade se for mantido cronicamente.

Estudos demonstram que as modificações no ciclo vigília-sono e a dessincronização circadiana podem alterar as concentrações da leptina e da grelina, e também da insulina (TSCHÖP et al., 2001; SHEA et al., 2005; ATKINSON et al., 2008; SCHEER et al., 2009; MARQUEZE;

ULHÔA; CASTRO MORENO, 2014), e com a dessincronização interna do ritmo circadiano dos peptídeos envolvidos no controle da ingestão alimentar, principalmente da leptina, o desequilíbrio entre consumo e dispêndio energético pode ocorrer (GARAULET; ORDOVÁS; MADRID, 2010).

Ketchum e Morton (2007) afirmaram em seu estudo que o trabalho em turnos, que pode levar a dessincronização circadiana, tem sido associado ao aumento das taxas de obesidade e da SM, tanto por alterações nos padrões de sono e alimentar, como nas atividades diárias, e Sookoian e cols. (2007) observaram que este tipo de trabalho leva ao aumento da pressão arterial, da insulina e dos triglicerídeos. Beltrão e Pena (2013) em revisão bibliográfica realizada no Brasil, concluíram que os trabalhadores com horários irregulares apresentam maior prevalência da SM, sugerindo que esse resultado ocorre devido a fatores como o impacto direto na dessincronização do ritmo circadiano.

3 JUSTIFICATIVA

As modificações temporais a que os imigrantes estão expostos podem gerar impactos diretos em sua saúde (alterações cronobiológicas, fisiológicas e metabólicas) levando a desregulação do ritmo biológico (RAJARATNAM; ARENDT, 2001).

Condições crônicas de saúde como o diabetes, a obesidade e a hipertensão, que caracterizam a síndrome metabólica, são descritas entre imigrantes latinos na literatura (DUARTE; ESCRIVÃO JUNIOR; SIQUEIRA, 2013; SIQUEIRA, 2011). Contudo, estudos que investigaram condições crônicas em imigrantes nos Estados Unidos ainda são escassos e os que estão disponíveis não consideram ou não analisam separadamente dos demais imigrantes, os imigrantes brasileiros (BALDWIN et al., 2010; HALE; DO; RIVERO-FUENTES, 2010), o que demonstra a relevância do presente estudo.

Assim, é essencial identificar, inicialmente, as publicações que já foram realizadas sobre a síndrome metabólica e seus fatores de risco em imigrantes provenientes da América Latina nos EUA, bem como se os imigrantes brasileiros estão inseridos nessas publicações e como estão inseridos, seguido pela análise do sobrepeso e da obesidade nos imigrantes brasileiros em Massachusetts, tendo em vista que a obesidade é crescente em populações minoritárias nos EUA e é um dos principais fatores de risco da síndrome metabólica.

Além da emigração para os Estados Unidos, ultimamente, foi observado no Brasil uma expansão das imigrações, com um aumento de 451,18% entre os anos de 2000 e 2010, e estimativa de cerca de 1.900.000 imigrantes vivendo no país entre 2007 e 2014. Os países que mais enviam imigrantes para o Brasil podem ser divididos em grupos de acordo com as motivações da mudança, sendo as principais motivações a instabilidade econômica no país de origem, a busca por melhores condições sociais e de trabalho, e como reflexo de alguns acontecimentos que tornam o país mais atrativo, como a Missão de Paz no Haiti e o Programa Mais Médicos (UEBEL; RÜCKERT, 2017). Ainda, um aumento da imigração de venezuelanos para o Brasil tem sido observado desde 2017, quando foram registradas entradas de mais de 70,7 mil venezuelanos no país. Em 2018, registros de entrada de mais de 184 mil venezuelanos foram realizados (OLIVEIRA, 2020).

Esse estudo formou rede de pesquisa entre o Brasil e os Estados Unidos para elucidar inquietações relacionadas à saúde da população imigrante e suas implicações para a saúde pública brasileira, com a oneração do Sistema Único de Saúde (SUS), por exemplo. Estudo realizado com brasileiros retornados (brasileiros que emigraram para os EUA e retornaram para o Brasil) para a

região de Governador Valadares em Minas Gerais (SIQUEIRA; SIQUEIRA, 2017) demonstrou que 57% dos participantes apresentaram problemas de saúde após o retorno para o Brasil, 33% os desenvolveram enquanto viviam nos EUA e 15% apresentavam uma condição de saúde preexistente que se agravou no período em que viveu no exterior.

Os autores (SIQUEIRA; SIQUEIRA, 2017) observaram ainda que 67% dos participantes do estudo não possuíam plano de saúde, sendo usuários do SUS. O estudo relacionou o adoecimento do imigrante ao fato de não terem buscado o serviço de saúde no exterior com frequência devido ao alto custo (SIQUEIRA; SIQUEIRA, 2017), e ao medo da identificação e da deportação pelos imigrantes indocumentados (DUARTE; ESCRIVÃO JUNIOR; SIQUEIRA, 2013). Ainda, Siqueira e Siqueira (2017) observaram diferentes restrições no acesso ao serviço de saúde nos EUA pelo imigrante brasileiro, como a dedicação apenas ao trabalho, não querendo "perder tempo" com consultas médicas, a automedicação e o uso de remédios caseiros. Duarte, Escrivão Junior e Siqueira (2013) acrescentam também a má alimentação e o estresse sofridos no período de estadia no exterior, bem como a falta de informação aos motivos do adoecimento do retornado. Levando em conta essas recentes imigrações para o Brasil de populações vulneráveis, o estudo poderá, ainda, ser indutor de informações direcionadas as discussões com o Ministério da Saúde nas ações de prevenção/promoção da saúde.

4 OBJETO DE ESTUDO, PERGUNTA E HIPÓTESES

Neste estudo, os objetos de estudo são o sobrepeso e a obesidade em imigrantes brasileiros em Massachusetts, EUA. Sendo assim, o estudo buscou responder qual a tendência do sobrepeso e obesidade em imigrantes brasileiros em Massachusetts em um período de 12 anos?

Esta é uma tese composta por dois artigos, estando as hipóteses descritas para cada artigo.

1. A prevalência da síndrome metabólica e seus fatores de risco é maior na população imigrante latina, em relação à população latina nascida nos EUA;	Artigo 1
2. Estudos que avaliaram a síndrome metabólica e seus fatores de risco em imigrantes brasileiros são escassos na literatura;	
3. As tendências de sobrepeso e obesidade em imigrantes brasileiros residentes em Massachusetts são crescentes ao longo dos anos.	Artigo 2

5 **OBJETIVOS**

5.1 GERAL

Avaliar a tendência temporal do sobrepeso e obesidade em imigrantes brasileiros em Massachusetts, EUA, de 2009 a 2020.

5.2 ESPECÍFICOS

- Identificar a prevalência da síndrome metabólica e seus fatores de risco em imigrantes latinos nos EUA;
- Realizar meta-análise das prevalências da síndrome metabólica e seus fatores de risco nestes imigrantes;
- Analisar o sobrepeso e a obesidade em imigrantes brasileiros em Massachusetts de 2009 a 2020;
- Investigar as taxas brutas e estratificadas do sobrepeso e obesidade em nesta população;
- Estimar as curvas de tendência para o sobrepeso e obesidade nesta população.

6 MATERIAL E MÉTODO

A condução do presente estudo ocorreu em parceria entre a Escola Nacional de Saúde Pública Sérgio Arouca (ENSP/Fiocruz) e a *School for the Environment, UMass Boston*. Este estudo foi constituído de dois artigos, que contemplam sua própria metodologia de forma a atender os objetivos propostos.

7 RESULTADOS

7.1 ARTIGO 1: SYSTEMATIC REVIEW AND META-ANALYSIS OF THE METABOLIC SYNDROME AND ITS COMPONENTS IN US IMMIGRANTS

Systematic review and Meta-Analysis of the Metabolic Syndrome and its components in US immigrants

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Abstract

The Metabolic Syndrome (MetS) is an increasingly prevalent condition globally. Latino populations in the USA have shown an alarming increase in factors associated with MetS in recent years. The objective of the present review was to determine the prevalence of MetS and its risk factors in immigrant latinos in the USA and perform a meta-analysis of these prevalences. The review included cross-sectional, cohort or case-control studies involving adult immigrant latinos in the USA, published during the period 1980-2020 in any language. Studies involving individuals who were pregnant, aged< 18 years, immigrant non-latinos, published outside the 1980-2020 time window, or with other design types were excluded. The Pubmed, Web of Science, Embase, Lilacs, Scielo and Google Scholar databases were searched. The risk of bias was assessed using the checklists of the Joanna Briggs Institute. The review included 60 studies and the meta-analysis encompassed 52 studies. The pooled prevalences found for hypertension, diabetes, general obesity and abdominal obesity were 28% (23%-33%), 17% (14%-20%), 37% (33%-40%) and 54% (48%-59%), respectively. The quality of the evidence was classified as low or very low. Few studies including immigrants from South America were identified. Further studies of these immigrants are needed due to the cultural, dietary and language disparities that exist among Latin American countries. The research protocol was registered with the OSF (doi 10.17605/OSF.IO/JFM7G).

Keywords: Metabolic Syndrome; Latinos; Immigrants; United States

1. **Introduction**

The last few decades have seen a shift in the morbidity-mortality profile of the population globally, first in developed countries and then in developing nations. The epidemiological transition theory was first put forward by Omran [1] in 1971, based on the complex relationship observed between changes in patterns of health and disease, their determinants, and the socioeconomic and demographic consequences. According to the theory, this transition stems from long-term changes in patterns of mortality and illness in which epidemics and pandemics

caused by infectious diseases are gradually giving way to an increased occurrence of chronic-degenerative diseases as the leading cause of morbidity and death.

According to Omran [1], the transition from the predominance of infectious-contagious diseases to chronic diseases is complex, involving three main groups of determinants: ecobiological, representing the balance between disease agents, level of hostility in the environment and host resistance; socioeconomic, political and cultural factors, which include standards of living, health and hygiene habits and nutrition; and medical and public health determinants, with specific preventive and curative measures implemented to fight diseases.

There is currently a steady increase in chronic diseases and health conditions, particularly cardiovascular disease, diabetes, cancers and obesity. Regarding obesity, this is now considered a global epidemic, with the United States (USA) numbering one of the first countries to show that rising obesity was becoming epidemic [2,3]. Obesity, together with hypertension, diabetes and dyslipidemia, is one of the main risk factors for Metabolic Syndrome (MetS), a condition that has been widely described and whose prevalence tends to accompany rises in obesity [4,5].

The MetS, previously referred to as the X Syndrome, was first described by Reaven [6] in his study on the role of insulin resistance in diseases and its inter-relationship with hypertension, type 2 diabetes and cardiovascular diseases. The National Cholesterol Education Program (NCEP) [7] later produced the first standardized definition of MetS, later updated in 2005 by Grundy et al [8] with a change in the fasting glucose reference value from >110mg/dl to >100mg/dl.

Currently, the diagnostic criteria for MetS are the co-occurrence of three or more of the following factors: high waist circumference (≥102cm in men and ≥88cm in women) or BMI>30kg/m² (WHO [9]); high triglycerides ((≥150mg/dL or 1.7mmol/L) or treatment for high triglycerides; low HDL cholesterol (<40mg/dL or 1.03mmol/L in men and <50mg/dL or 1.3mmol/L in women) or treatment for low HDL cholesterol; high blood pressure (systolic ≥130mm/Hg and diastolic ≥85mm/Hg) or treatment for systemic arterial hypertension; and high fasting blood glucose (≥100mg/dL) or treatment for type 2 diabetes.

In a 2020 study of US Adults [10], the authors found an MetS prevalence of 61.6% in obese individuals, 33.2% in overweight subjects, and 8.6% in adults with normal weight, highlighting the strong link between obesity and MetS.

Despite the increasing prevalence of obesity seen in the general population of the USA over recent years (doubling between 1980 and 2010), this rate has now stabilized at around 35%. However, this rise remains alarming among minority populations, especially latinos and

black non-latinos [5,11]. Similar increases for hypertension, diabetes, and high cholesterol have been documented in latinos between 2001 and 2020 [12].

High rates of the factors associated with MetS in immigrant latinos in the USA have been observed in previous studies, particularly among Mexicans [13–15]. Two systematic reviews [16,17] found increased obesity in latinos, attributing this rise to higher levels of acculturation and residence in the USA, as well as immigrant generational and nativity status. The increase in obesity (and in the other diseases defining MetS) seen among immigrant populations is often associated with the nutritional transition occurring in developing countries, together with shifts in dietary habits and levels of physical activity, factors highlighted in both reviews [16,17]. For Brazil, a country which has been undergoing a process of nutritional transition since the 1970s [18], data from the Vigitel Brasil system [19] reveals an increase in the risk factors for chronic diseases, particularly overweight and obesity, indicating an increased risk of developing metabolic syndrome.

It is noteworthy that immigrants from developing countries undergoing a process of nutritional transition who emigrate to developed countries with a highly obesogenic environment are subject to an acceleration in the process of nutritional transition, favoring the development of obesity and its associated factors [16]. Nonetheless, when assessing these factors, it is important that cultural, language, economic and social characteristics of the immigrants be taken into account, as well as origin.

Another key point is the high likelihood of Brazilian immigrants not having been included in samples of most of the studies conducted in the USA, owing to the classification adopted by the US Census for the latino population. In general, individuals with a Cuban, Mexican or Porto Rican background/origin are classified as Hispanic or Latinos, whereas those from other Central and South American countries are identified as “others with Hispanic, Latino or Spanish origin” [20]. Thus, the generalization for Brazilian immigrants of health information identified in studies of immigrants in the USA, using the term “latino” as a reference, may not be appropriate.

Given the epidemiological transition that has taken place and is still underway globally, in which chronic diseases feature as the leading cause of morbidity-mortality, and the growth in diseases associated with MetS in immigrant latinos in the USA, identifying the publications involving this population to accurately determine the prevalence of MetS and its components is crucial.

However, the vast majority of publications on the health conditions immigrant latinos in the USA include only immigrants from Mexico and Central America. Thus, how or whether

South-American (including Brazilian) immigrants are involved in these studies remains unclear. In view of the cultural and economic heterogeneity that exists across Latin America, with countries such as Brazil having a different language, culture, customs and eating habits from other Latin American nations, analyses centering on this population are important.

Therefore, the objective of the present review was to determine the prevalence of MetS and its risk factors among immigrant latinos in the USA and perform a meta-analysis of these rates. This review also sought to ascertain, in the available publications, the latino groups included in these analyses and the extent to which Brazilians feature in these studies.

2. **Materials and Methods**

2.1 *Protocol*

The present systematic review of the literature was carried out according to the PICO (Population, Intervention/Exposure, Comparator(s)/Control e Outcomes) strategy, where:

- Population: Immigrants from Latin America, residing in the USA, aged >18 years;
- Intervention/Exposure: Immigration;
- Comparator(s)/control: US-born latino population;
- Outcomes: Metabolic syndrome and/or its components (primary) and sleep disorders (secondary).

The study protocol was devised based on the criteria established by PROSPERO (international prospective register of systematic reviews) and registered with the OSF before commencement of the review (doi 10.17605/OSF.IO/JFM7G). The systematic review yielded sufficient data to perform a meta-analysis of prevalences, where this was subsequently incorporated into the review. The systematic review was reported according to the guidelines of the PRISMA statement [21].

2.2 *Definition of Outcomes*

The primary outcomes included in the present review were the Metabolic Syndrome and/or its risk factors: high blood pressure or diagnosis/treatment of arterial hypertension; high fasting blood glucose or diagnosis/treatment of type 2 diabetes mellitus; low HDL-c or treatment for low HDL-c; high triglycerides or treatment for high triglycerides; and high waist circumference or BMI>30kg/m² [9,7]. Secondary outcomes were sleep disorders.

Based on the codes of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) [22], the relevant categories for this review were: E88.8 – other specified metabolic disorders (metabolic syndrome), I10 – essential hypertension (primary), E78 – Disorders of lipoprotein metabolism and other lipidemias, E11 – type 2 diabetes mellitus, E66 – obesity, G47 – sleep disorders.

2.3 *Search Strategy*

The search strategy was devised to include all important descriptors needed to retrieve the relevant studies for the review, as outlined below:

1.

"Metabolic Syndrome"[Mesh] OR "metabolic syndrome"[TIAB] OR "Obesity"[Mesh] OR "obesity"[TIAB] OR "overweight"[MeSH Terms] OR "overweight"[TIAB] OR "waist circumference"[TW] OR "hypertension"[MeSH Terms] OR "hypertension"[TIAB] OR "dyslipidemias"[MeSH Terms] OR dyslipidemia*[TIAB] OR "hypertriglyceridemia"[MeSH Terms] OR "hypertriglyceridemia"[TIAB] OR "high triglycerides"[TIAB] OR "hyperglycaemia"[TIAB] OR "hyperglycemia"[MeSH Terms] OR "hyperglycemia"[TIAB] OR BMI OR “body mass index” OR “body weight” OR “Blood pressure” OR “high lipids” OR “HDL” OR "diabetes mellitus, type 2"[MeSH Terms] OR "type 2 diabetes mellitus"[TIAB] OR "diabetes type 2"[TIAB] OR "insulin resistance"[MeSH Terms] OR "insulin resistance"[TW] OR “sleep"[MeSH Terms] OR "sleep wake disorders"[MeSH] OR "sleep wake disorders"[TIAB] OR "sleep disorders"[TIAB]

2.

"Emigration and Immigration"[Mesh] OR IMMIGRATION[TW] OR IMMIGRANT*[TIAB] OR EMIGRATION[TIAB] OR migration[TW] OR migrant*[TIAB] OR “foreign-born”[TW] OR “country of origin”[TW] OR “region of birth”[TIAB] OR “region of origin”[TIAB]

3.

AMERICA* [TIAB] OR USA[TIAB] OR “UNITED STATES”[TIAB] OR AMERICAS[MESH] OR Canada[TIAB] OR Canadian*[TIAB] OR “North America”[TIAB]

4.

#1 AND #2 AND #3

5.

#4 NOT (ASIA*[TIAB] OR EUROPEAN[TIAB] OR INDIAN[TIAB] OR CHINESE[TIAB] OR JAPANESE[TIAB] OR UKRANIAN[TIAB])

The Pubmed, Web of Science, Embase, Lilacs, Scielo databases were searched, along with Google Scholar as a complementary source, with no restrictions regarding language of publication. The search strategy was applied for the last time on the 3rd June 2020.

2.4 *Study Selection*

Studies that met the inclusion criteria listed below were selected for inclusion in the review:

- Cross-sectional, cohort or case-control type study;
- Involving adults (>18 years);
- Investigating immigrant latinos residing in the USA;
- Published during the period 1980-2020 in any language.

Studies involving pregnant women, immigrants from countries other than Latin America, children and adolescents (<18 years), published outside the 1980-2020 period or based on data collected prior to 1980, qualitative or case studies and those with non-original data, were excluded from the review.

Two reviewers (TP, DC) independently screened titles and abstracts of the articles retrieved using the search strategy, by applying the Rayyan [23] app and Excel® spreadsheets. The full texts of the articles selected were then obtained, reviewed and categorized as "included" or "excluded" by the same reviewers (TP, DC) in a double-blind analysis, according to the predefined inclusion criteria, documenting the reasons for exclusion using the Rayyan app [23]. At both stages, any discrepancies were checked by a third reviewer (LT).

2.5 *Data Extraction*

For all articles included in the previous stage, three reviewers (TP, DC, CN) extracted the data independently using an extraction spreadsheet previously created and validated by the research team, containing the following parameters:

- Study characteristics: authors, year of publication, author affiliations, e-mail of corresponding author and study title;

- Study population: Total number of participants, total number of women and men, whether study stratified analyses by Brazilian immigrants, immigrant groups studies, age, country of origin, comparative group and length of residence in the USA;
- Study design: design type and study period;
- Exposures;
- Other risk factors: work, shift work, documented or otherwise, and health insurance;
- Outcomes: metabolic syndrome, hypertension or high blood pressure, type 2 diabetes or high fasting glucose, low HDL-c, high triglycerides, abdominal obesity or BMI > 30kg/m² (primary) and sleep disorders (secondary).

2.6 *Risk of Bias*

The risk of bias of the studies included was assessed using the checklists of the Joanna Briggs Institute (JBI): Critical Appraisal Checklist for Analytical Cross-Sectional Studies, Checklist for Case-Control Studies, and Checklist for Cohort Studies [24]. Located within the Faculty of Health Sciences of Adelaide University, the JBI is an international research and development organization world-renowned for evidence-based healthcare [24].

Given systematic reviews represent a summary of core evidence, the JBI developed processes for the critical evaluation and synthesis of evidence to aid decision-making in health. The 8 domains of risk of bias included in the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies are: (i) clearly defined criteria for inclusion; (ii) description of study subjects and setting; (iii) valid and reliable measurement of exposure; (iv) use of objective, standard criteria; (v) identification of confounding factors; (vi) strategies for dealing with confounding factors; (vii) measurement of outcomes; and (viii) appropriate statistical analysis[24].

The JBI Critical Appraisal Checklist for Case Control Studies has 10 domains: (i) comparability of the groups;; (ii) appropriateness of matching of cases and controls; (iii) criteria used for identification of cases and controls; (iv) valid and reliable measurement of exposure; (v) identification of confounding factors; (vi) identification of confounding factors; (vii) strategies for dealing with confounding factors; (viii) measurement of outcomes; (ix) length of exposure period of interest; and (x) appropriate statistical analysis [24].

The JBI Critical Appraisal Checklist for Case-Control Studies has 10 domains: (i) comparability of the groups; (ii) appropriateness of matching of cases and controls; (iii) criteria used for identification of cases and controls; (iv) valid and reliable measurement of exposure;

(v) identification of confounding factors; (vi) identification of confounding factors; (vii) strategies for dealing with confounding factors; (viii) measurement of outcomes; (ix) length of exposure period of interest; and (x) appropriate statistical analysis [24].

For each study included, the questions from the respective JBI Checklist were answered with a “yes” ,“no”, “unclear” or “not applicable”. The general risk of bias for each study was determined according to the following cut-off points [24]:

- ≥70% “yes” answers: low risk of bias;
- 50-69% “yes” answers: moderate risk of bias;
- <50% “yes” answers: high risk of bias.

Three of the study´s reviewers (TP, DC, CN) independently rated the risk of bias for each study included in the review, and a fourth reviewer (LT) settled any disagreements or discrepancies.

2.7 *Analysis and Presentation of Results*

The results obtained in the systematic review were first presented in the form of a map of evidence, in which all articles reviewed were included (study design, number of participants, characteristics of population, study site and outcome) for later analysis and discussion of findings.

A meta-analysis of the prevalences of risk factors for the MetS was then performed. The clinical heterogeneity of studies included that had the same outcome was assessed independently by two authors, with a third author settling any disagreements. Given the studies assessed many different, yet related, effects, these were pooled using the inverse variance technique, employing random-effect models. The software Stata version 15.0 was used for statistical analysis. The I2 statistic was used to analyze the statistical heterogeneity of the studies. Pooled effect estimates were presented based on the meta-analysis, even when the statistical heterogeneity was high (I2>70%), given that high levels of statistical heterogeneity were expected.

The quality of the evidence was analyzed using the assessment criteria of the GRADE (Grading of Recommendations Assessment, Development and Evaluation) system, the most widely used instrument for assessing the quality of evidence of studies included in systematic reviews [25]. GRADE differs from other evaluation instruments by: separating quality of evidence and strength of recommendation; rating quality of evidence for each outcome of interest; and allowing the level of quality of evidence of observational studies to be rated up if 3 criteria

are met, namely, large effect size, presence of dose-response gradient, and residual confounding factors which increase confidence in estimates [25]. Forest plots were used in the meta-analyses for outcomes rated as very low quality of evidence, although combined estimates were not shown. The results of the synthesis of the evidence are given in the summary table of findings.

3. **Results**

3.1 *Study Selection*

Of the 2501 studies retrieved after applying the search strategy, 60 studies met the criteria for inclusion in the systematic review. Of this total, 52 studies were subsequently included in the meta-analysis, as depicted in the flow diagram below, according to the model established by the PRISMA statement [21] (Figure 1). The 8 studies excluded from the meta-analysis lacked the parameters required to estimate prevalence.

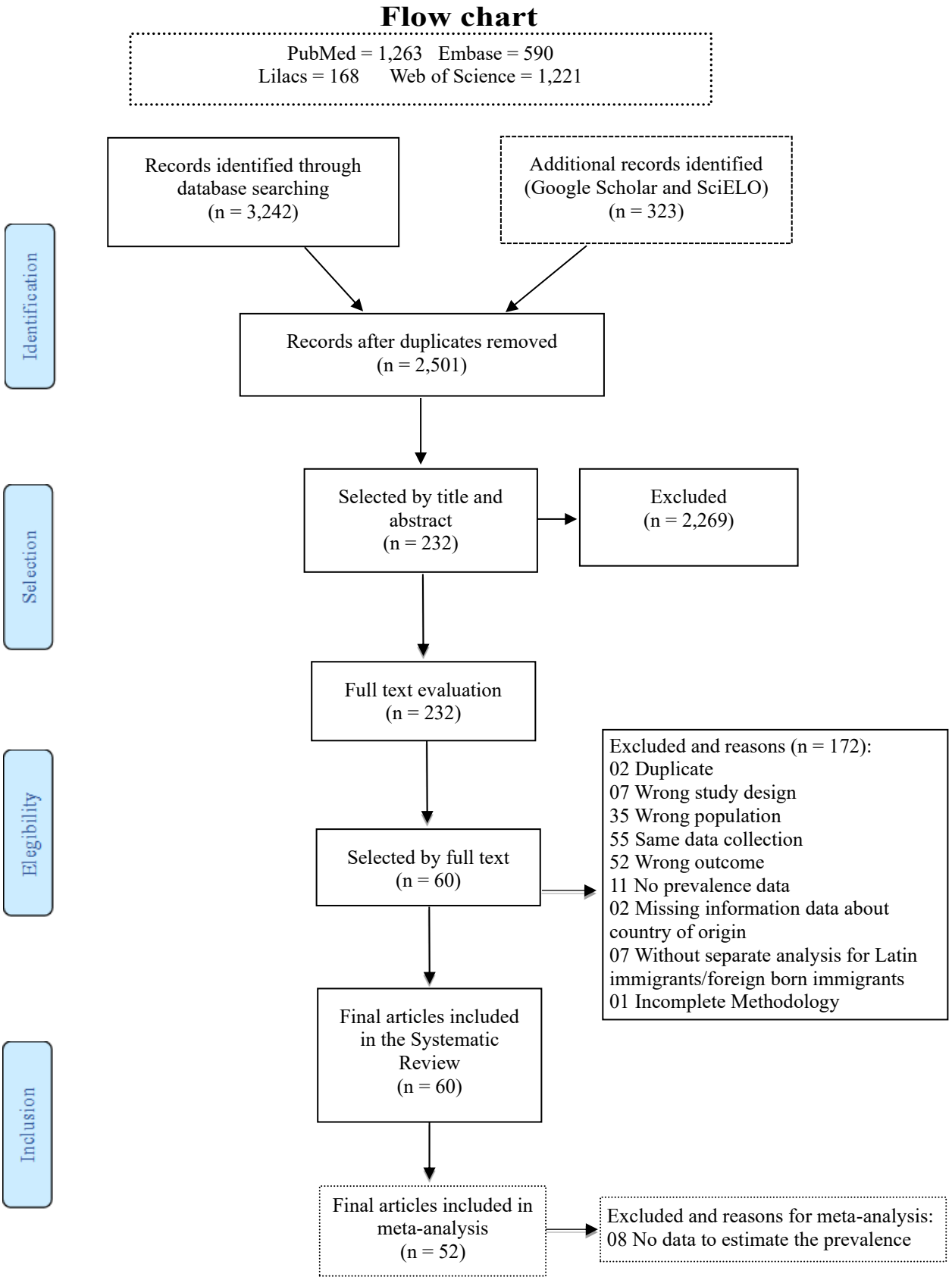


Figure 1. Flow chart of study selection process. Source: model extracted from Page et al. [21]

3.2 *Study Characteristics*

The total number of participants from all studies included in the review was 2,709,490. Most studies had a cross-sectional design (55) [14,15,26–78], followed by 4 cohort studies [13,79–81] and 1 case-control [82] study. Only two studies stratified Brazilian immigrants in their analyses [30,47]. Regarding country of origin of the immigrants studied, 14 studies involved Mexicans only [14,26,27,42,43,52,64,65,74–77,79,81], 11 Mexicans and other Latinos [15,33,34,36,49,51,54,61,63,66,67], 10 investigated immigrants from South and Central America (Brazil [30,47], Haiti [30,32], El Salvador [30,40], Colombia [30], Guatemala [30,40], the Dominican Republic [30,46], Honduras [30,40], Peru [40], Bolivia [40], Porto Rico [32,46], Mexico [46], Guiana [82] and other unspecified countries [32,35,38,39,45,46,82]), and 7 studied immigrants from Central America (Dominican Republic [69,72,80], Porto Rico [69,72,80], Cuba [69,72], Mexico [72,78], El Salvador [78], Guatemala [78], Honduras [78], Haiti [56,59] and other unspecified countries [37,69,80]).

Participant age ranged from 0 to 91 years. Only one study included children and adolescents in its sample [56] (age group 0 to ≥75 years). However, the analysis was stratified by age group, allowing data for subjects aged >18 years to be extracted.

Length of residence of the immigrants in the USA was assessed in 36 studies. Of these publications, 12 stratified length of residence into < 10 years and > 10 years [26,28,32,34,35,38,39,42,58,70,78,81]. The other studies included immigrants with < 10 years of residence in the USA [30,65],< 15 and > 15 years [29,44,53,54,56], < 20 and >20 years [41,50,66,74,80], or <25 and >25 years of residence [13]. Eleven studies [15,40,47,51,52,55,61,64,67,75,77] reported only average years of residence.

The exposures assessed in the studies were grouped under 4 categories: related to immigration, the immigrant, health, diet and life-style, and the community. The distribution of exposures for the different categories is presented in Table 1.

Table 1. Exposures Assessed in Studies Reviewed

Immigration-related	**Immigrant-related**	**Health, dietary and lifestyle-related**	**Community-related**
Generational status [13]	Nativity [26,35,42,54,72]	Health behaviors [15,34]	Immigrant concentration [49,68]
Length of residence in US [13,26,36,39,47,72,81]	Agricultural work [31,33,61]	Health assimilation; health literacy; nutrition transition; dietary characteristics [41,47,51,80]	Community factors [58,68]
Migration history [34]	Income; Sociodemographic factors [31,32,47,53,68,70]	Healthcare services access and utilization [56,62]	
Immigration [14,27–31,45,82]	Ethnicity [37,44]	Food insecurity [64,65]	
Acculturation [15,50,54,58,66,73,78–80]	Occupation [44]	lifestyle; environment; lifestyle predictors; physical activity patterns [53,69,73]	
Age at immigration [79]	Age [81]	Hypertension; type 2 diabetes; metabolic syndrome; family history of type 2 diabetes; cardiovascular risk factors [57,60,68,75,77]	
Migrant status [43,44,81]	Social determinants of health [67]	Psychiatric disorders; substance use [71]	
Discrimination [48,52,55]		Worry about deportation [74]	
Residential mobility [42]		Health status [15]	

In total, 17 articles analyzed work-related factors [15,31,33,39,41,43,44,46,47,53,55,61,64,66–68,70] and 9 described participant occupations, of which, 4 involved rural or agricultural workers [31,33,61,70], 2 taxi/for-hire vehicle drivers, 1 professional/management and service services workers [44], 1 female homemakers and others[66], while 1 encompassed a broad group of workers [15], dividing participants into: skilled professional, semiskilled white-collar, clerical, semiskilled blue-collar, unskilled service, laborer, farmworker; homemaker; unemployed or student. Four studies addressed the issue of immigrant documentation in their results [43,46,61,76] and 19 included information on holding health insurance or otherwise [28,31,33,36,37,39,40,45,46,49,54–57,63,68,75,78,80]. The characteristics of the studies included in the review are presented in Table 2.

Table 2. Characteristics of studies reviewed

Study ID	Total study participants	Female	Male	Age group	Country of birth	Comparison group	Time in the US	Study design	Study period	Exposures	Immigrant worker	Occupation	Documentation	Health Insurance
Ahmed, 2009[13]	70110	0	70110	45-69		US born black and white	<10y; 11-15y; 16-25y; >25y	Cohort	2002-2003	Generational status; length of residency in the US	No			
Albrecht, 2013[26]	8149	3914	4235	20-64	Mexico	US born Mexicans	<10y; >10y	Cross-sectional	1988-1994; 1999-2008	Nativity; length of residency in the US	No			
Altman, 2017[27]	25499	25499	0	20-64	Mexico	Mexicans in Mexico; US-born Mexicans; US-born non-hispanics whites/blacks		Cross-sectional	1999-2009 NHANES (United States); 2006 ENSANUT (Mexico)	Immigration	No			
Angel, 2008[28]	1975	1153	822	20 - not specified		Non-hispanic whites, blacks and asians	<10y; >10y	Cross-sectional	June-December 2004	Immigration	No			Yes
Antecol, 2006[29]	490806	258718	232088	20-64		Natives (hispanics, whites and blacks)	0-4y; 5-9y; 10-14; 15y+	Cross-sectional	1989-1996	Immigration	No			
Anzman-Frasca, 2016[30]	345	345	0	20-55	Brazil; Haiti; El Salvador; Colombia; Guatemala; Dominican Republic; Honduras	Between groups	<10y	Cross-sectional	March and June 2010 (first wave); May and June 2011 (second wave)	Immigration	No			
Back, 2012[82]	1096	441	655	30 - not specified	Guyana; Other			Case-Control	May 1 2004 - April 30 2006	Immigration	No			
Beltrán-Sánchez, 2016[14]	15957	9022	6935	20-50+	Mexico	US born Mexican American; Mexican living in Mexico; Non-Hispanic Whites		Cross-sectional	ENSANUT 2006; NHANES 1999-2000 and 2009-2010	Immigration	No			

Study ID	Total study participants	Female	Male	Age group	Country of birth	Comparison group	Time in the US	Study design	Study period	Exposures	Immigrant worker	Occupation	Documentation	Health Insurance
Boggess, 2016[31]	793188	427528	365660	18-60+				Cross-sectional	2012	Agricultural work (seasonal and migratory); immigration; low income	Yes	Agricultural workers (seasonal or migratory)		Yes
Briones, 2016[76]	31305	11402	19903	<35-65+	Mexico			Cross-sectional	2010		No		Yes	
Caspi, 2017[32]	800	636	164	18-60+	Puerto Rico; Haiti; other	Us born	0-5y; 5-10y; 10y+	Cross-sectional	February 2007 and June 2009	Low income immigrants	No			
Castañeda, 2015[33]	282	163	118			Migrant or seasonal status		Cross-sectional	2002-2004	Migrant or seasonal status	Yes	Farm-workers		Yes
Chakraborty, 2003[34]	390	390	0	18-65	Mexico; Other		<5y; 5-9y; 10y+	Cross-sectional	1993	Migration history; health behavior changes - mediator	No			
Choi, 2012[35]	7786	4287	3499		Central and South America	Origin	<1y; 1–4y; 5–9y; 10y+	Cross-sectional	2003	Nativity	No			
Chrisman, 2017[79]	18298	14048	4250	21-94	Mexico	US born		Cohort	Start year 2001	Language acculturation; age at immigration	No			
Coffman, 2012[36]	144	113	31		Mexico; Central and South America; Other			Cross-sectional		Recent latino immigrants	No			Yes
Cohn, 2017[68]	3317	1523	1794	30-74		Non-hispanic whites		Cross-sectional	2010 (US Census); 2012 - 2013 (hospital data)	CVD risk factors (individual factors); median household income and Hispanic concentration (neighborhood-level)	Yes			Yes
Davis, 2007[37]	189	98	91	18-40	Central America	African American; US born African Caribbean		Cross-sectional		Ethnicity	No			Yes

Study ID	Total study participants	Female	Male	Age group	Country of birth	Comparison group	Time in the US	Study design	Study period	Exposures	Immigrant worker	Occupation	Documentation	Health Insurance
Dawson, 2019[67]	181	0,663	33,7%	18-64	Mexico; Central America		Mean 21.6 (16.2); Median 19	Cross-sectional		Social determinants of health	Yes			
Del Brutto, 2013[69]	3850	2413	1437	40 - not specified	Dominic Republic; Puerto Rico; Cuba; and other	Coastal Ecuador population (Atahualpa)		Cross-sectional	1993-2001; Jun-Oct 2012	Lifestyle; environment	No			
Elfassy, 2018[38]	16156	8498	7658		Central and South America	Between groups	<10y; >10y	Cross-sectional	2008-2011		No			
Gany, 2016[39]	413	1	412	18-60+	Central and South America		<10y; >10y; US born	Cross-sectional	September-October 2011	Length of residence in the US	Yes	Taxi drivers		Yes
Gill, 2017[40]	1042	704	338	18-87	El Salvador; Honduras; Peru; Guatemala; Bolivia	Between groups	Mean: 8.8 years	Cross-sectional			No			Yes
Giuntella, 2017[41]	729793	387502	342291	25-64		US born	<10y; 10-15y; 15-20; >20	Cross-sectional	1989-2014	Health assimilation	Yes			
Glick, 2015[42]	525	372	153	18-60	Mexico	Mexicans in Mexico	<10y; 10y+ speaking Spanish; 10y+ English or bilingual; US born	Cross-sectional	March 2009 (USA); May-June 2009 (Mexico)	Nativity; residential mobility	No			
Heer, 2013[75]	1002	660	342		Mexico	Mexican-Americans without diabetes	Diabetes: mean 40.9y (SD 18.6) No diabetes: mean 33.0y (SD 17.5)	Cross-sectional	Nov. 2009 - May 2010	Diabetes	No			Yes

Study ID	Total study participants	Female	Male	Age group	Country of birth	Comparison group	Time in the US	Study design	Study period	Exposures	Immigrant worker	Occupation	Documentation	Health Insurance
Hubert, 2005[15]	1005	380	521	18-64	Mexico; Other		Mean	Cross-sectional	July-December 2000	Health status; health behaviors; acculturation	Yes	Skilled professional; Semiskilled white-collar, clerical; Semiskilled blue-collar; Unskilled service, laborer; Farmworker; Homemaker; Unemployed or student		
Iten, 2014[43]	401	207	194		Mexico	US born Mexican Americans; Documented Mexican immigrants		Cross-sectional	2008-2009	Immigrant status	Yes		Yes	
Jackson, 2014[44]	175244	28730	30484	18-65+		Non-hispanic whites and blacks	<15y; 15y+	Cross-sectional	2004-2011 (NHIS)	Immigrant status; race/ethnicity occupation	Yes	Professional/ management; Support Services		
Jaranilla, 2014[45]	59791	33025	26766	20-65+	Central and South America	US born		Cross-sectional	Jan-Dec 2010	Immigration	No			Yes
Jerome-D'Emilia, 2014[46]	66	66	0	21-79	Puerto Rico; Dominican Republic; Mexico; Other	Between groups		Cross-sectional			Yes		Yes	Yes
Klabunde 2020[47]	361	191	170	18-74	Brazil		Mean: 12.7 (SD 6.7)	Cross-sectional	Dec 2013 - Mar 2014	Socio-demographic factors; dietary characteristics; length of residence in the US	Yes			
LeBrón, 2020[48]	213	138	75			Non-hispanic whites and blacks		Cross-sectional	2002–2003 2007–2008	Discrimination	No			

Study ID	Total study participants	Female	Male	Age group	Country of birth	Comparison group	Time in the US	Study design	Study period	Exposures	Immigrant worker	Occupation	Documentation	Health Insurance
Li, 2017[49]	1563	1080	483	18-91	Puerto Rico; Mexico; others			Cross-sectional	2006-2008 (Survey) 2005-2009 (ACS)	Immigrant concentration; latino density	No			Yes
Lopez-Cevallos, 2019[70]	3382	673	2709	18-74			0-5y; 6-9y; >10y	Cross-sectional	2004-2012	Sociodemographic factors	Yes	Farm-workers		
López, 2016[80]	744	405	339	30-72	Puerto Rico; Dominican Republic; others		5-10y; 10-15y; 15-20; >20	Cohort	January 2010-March 2012	Acculturation; Health Literacy	No			Yes
López, 2019[50]	1818	1187	631	45 - not specified			<5y; 5–10y; 11–20y; >20y	Cross-sectional		Acculturation	No			
Martínez, 2014[51]	149	98	51	20-77	Mexico; Central and South America		Mean: 10.24 (SD 10.12)	Cross-sectional	2011	Nutrition transition	No			
McClure, 2010[52]	132	86	46		Mexico	US population	Women: 9.5 (SD 6.9); Men: 13.5 (SD 9.4)	Cross-sectional		Discrimination	No			
Narang, 2020[53]	983	0	983	19-76			≤2y; 3-9y; 10-15y; ≥16y	Cross-sectional	Dec. 2010 - Nov. 2017	Demographic factors; lifestyle predictors	Yes	Taxi drivers; For-hire vehicle drivers		
Nelson, 2007[77]	205				Mexico		Mean 25.7 (SD 16.4)	Cross-sectional	April 2004 - Oct. 2005	Family History of Diabetes	No			
Pickering, 2007[71]	43093	24575	18518	18-65+				Cross-sectional	2001-2002	Psychiatric disorders (mood, anxiety and personality disorders); substance use (alcohol, drugs and nicotine)	No			
Rodriguez, 2012[54]	160081	81164	78917		Mexico; Central and South America; Other	US born Hispanics; non-hispanic white	≤1-4y; 5-9y; 10-14y; >15y	Cross-sectional	2001, 2003, 2005, and 2007	Acculturation; nativity	No			Yes

Study ID	Total study participants	Female	Male	Age group	Country of birth	Comparison group	Time in the US	Study design	Study period	Exposures	Immigrant worker	Occupation	Documentation	Health Insurance
Rodriguez, 2020[72]	787	787	0	40-65	Dominic Republic; Puerto Rico; Cuba; Mexico	US born		Cross-sectional	2012-2018	Nativity; migration timing	No			
Ryan, 2006[55]	666	453	213			African Americans	Latino Immigrants: mean 4.47	Cross-sectional	2002-2003	Discrimination	Yes			Yes
Saint-Jean, 2005[56]	680	340	340	0-75+	Haiti	With and without insurance	<5y; 5–10y; 11–14y; 15y+	Cross-sectional	2001	Health services utilization	No			Yes
Salinas, 2014[81]	1936	1302	634	18-80	Mexico	US born	≤10y; >10y; US born	Cohort	2004-2007	Immigrant status; length of residence in the US; age	No			
Shelley, 2011[57]	2585	1592	993			Non-hispanic whites and blacks		Cross-sectional	2007-2008	Hypertension	No			Yes
Shi, 2015[58]	15471	8049	7422	18-65+		White	0–4y; 5–10y; 10y+; US born	Cross-sectional	2005 and 2007	Acculturation; Community Factors	No			
Singh-Franco, 2013[59]	114	85	29			Non-Haitians		Cross-sectional	Jan 2003 - May 2008	Intervention of a multidisciplinary team	No			
Slattery, 2006[73]	2039	2039	0	<40-79		Non-hispanic whites		Cross-sectional		Language acculturation; physical activity patterns	No			
Tehranifar, 2015[60]	373	373	0	40-64		With and without MetS		Cross-sectional	November 2012 and May 2014	Metabolic syndrome	No			
Torres, 2018[74]	545	545	0		Mexico		<15y; 16–20y; >21y; US born	Cross-sectional	March 2012 August 2014	Worry about deportation	No			
Vaeth, 2005[78]	1163	624	539	18-65	Mexico; El Salvador; Guatemala; Honduras		<5y; 5-10y; 10y+	Cross-sectional	July 2000 - October 2002	Acculturation	No			Yes
Villarejo, 2010[61]	654	238	416		Mexico; Other	Males and Females	Males: median 14 Females: median 9	Cross-sectional	1999	Agricultural work	Yes	Farm-workers	Yes	

Study ID	Total study participants	Female	Male	Age group	Country of birth	Comparison group	Time in the US	Study design	Study period	Exposures	Immigrant worker	Occupation	Documentation	Health Insurance
Viruell-Fuentes, 2012[62]	804	456	348					Cross-sectional	May 2001 - March 2003	Access to care; Neighborhood effects	No			
Wassink, 2017[63]	3731	1921	1810	24-32	Mexico; Cuba; Central and South America	Migrant generation, Blacks		Cross-sectional	Phase I (1994–95), III (2001–02) and IV (2008–09).		No			Yes
Weigel, 2019[64]	75	67	8	40-84	Mexico	Food insecure; food secure	Mean: 19,9 ± 15	Cross-sectional	April-May 2015	Food insecurity	Yes			
Weigel, 2007[65]	100	43	57	18-61+	Mexico		≤10y	Cross-sectional	10-month period in 2003	Food insecurity	No			
Wolin, 2009[66]	388	388	0	40-77	Mexico; Other		≤10y; 11–20y; >20y	Cross-sectional	November 2000 and June 2002 (Phase I); May 2003 and June 2004 (Phase II)	Acculturation	Yes	Homemaker; other		

3.3 *Risk of Bias*

For the 55 cross-sectional studies included in the systematic review, the overall scoring of risk of bias ranged from 25.5-100% for the 8 domains of the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies (Table 3). Most of the studies (50) had low risk of bias, 3 had moderate risk and 2 high risk of bias (Table 3).

Table 3. JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies

	Albrecht 2013	**Altman 2017**	**Angel 2008**	**Antecol 2006**	**Anzman-Frasca 2016**	**Beltrán-Sánchez 2016**	**Boggess 2016**	**Briones 2016**	**Caspi 2017**	**Castañeda 2015**	**Chakraborty 2003**	**Choi 2012**	**Coffman 2012**	**Cohn 2017**	**Davis 2007**
1. Were the criteria for inclusion in the sample clearly defined?	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	Y
2. Were the study subjects and the setting described in detail?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
3. Was the exposure measured in a valid and reliable way?	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	Y
4. Were objective, standard criteria used for measurement of the condition?	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	Y
5. Were confounding factors identified?	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	U	U	U	N
6. Were strategies to deal with confounding factors stated?	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	U	U	U	N
7. Were the outcomes measured in a valid and reliable way?	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	Y
8. Was appropriate statistical analysis used?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
% of "yes"	100%	100%	100%	100%	100%	100%	75%	25%	100%	100%	100%	75%	75%	62,5%	75%
Risk of bias	Low	Low	Low	Low	Low	Low	Low	High	Low	Low	Low	Low	Low	Moderate	Low

Y=yes, N=no, U=unclear

Table 3. JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies (cont.)

	Dawson 2019	**Del Brutto 2013**	**Elfassy 2018**	**Gany 2016**	**Gill 2017**	**Giuntella 2017**	**Glick 2015**	**Heer 2013**	**Huber t 2005**	**Iten 2014**	**Jackson 2014**	**Jaranilla 2014**	**Jerome-D'Emilia 2014**	**Klabunde 2020**	**LeBrón 2020**	**Li 2017**
1. Were the criteria for inclusion in the sample clearly defined?	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2. Were the study subjects and the setting described in detail?	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3. Was the exposure measured in a valid and reliable way?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y
4. Were objective, standard criteria used for measurement of the condition?	Y	Y	Y	Y	Y	NA	Y	Y	Y	Y	Y	Y	U	Y	Y	Y
5. Were confounding factors identified?	U	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	N	Y	Y	Y
6. Were strategies to deal with confounding factors stated?	U	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	N	Y	Y	Y
7. Were the outcomes measured in a valid and reliable way?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y
8. Was appropriate statistical analysis used?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
% of "yes"	75%	100%	100%	75%	100%	87,5%	100%	100%	75%	100%	100%	100%	37,5%	100%	100%	100%
Risk of bias	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	High	Low	Low	Low

Y=yes, N=no, U=unclear, NA=not-applicable

Table 3. JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies (cont.)

	Lopez-Cevallos 2019	**López 2019**	**Martínez 2014**	**McClure 2010**	**Narang 2020**	**Nelson 2007**	**Pickering 2007**	**Rodriguez 2012**	**Rodriguez 2020**	**Ryan 2006**	**Saint-Jean 2005**	**Shelley 2011**
1. Were the criteria for inclusion in the sample clearly defined?	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
2. Were the study subjects and the setting described in detail?	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y
3. Was the exposure measured in a valid and reliable way?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	U
4. Were objective, standard criteria used for measurement of the condition?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5. Were confounding factors identified?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	U
6. Were strategies to deal with confounding factors stated?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	U
7. Were the outcomes measured in a valid and reliable way?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8. Was appropriate statistical analysis used?	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
% of "yes"	100%	100%	87,5%	75%	87,5%	100%	100%	100%	100%	100%	75%	62,5%
Risk of bias	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate

Y=yes, N=no, U=unclear

Table 3. JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies (cont.)

	Shi 2015	**Singh-Franco 2013**	**Slattery 2006**	**Tehranifar 2015**	**Torres 2018**	**Villarejo 2010**	**Vaeth 2005**	**Viruell-Fuentes 2012**	**Wassink 2017**	**Weigel 2019**	**Weigel 2007**	**Wolin 2009**
1. Were the criteria for inclusion in the sample clearly defined?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2. Were the study subjects and the setting described in detail?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3. Was the exposure measured in a valid and reliable way?	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
4. Were objective, standard criteria used for measurement of the condition?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5. Were confounding factors identified?	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
6. Were strategies to deal with confounding factors stated?	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
7. Were the outcomes measured in a valid and reliable way?	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
8. Was appropriate statistical analysis used?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
% of "yes"	100%	100%	100%	100%	100%	100%	100%	50%	100%	100%	100%	100%
Risk of bias	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low

Y=yes, N=no, U=unclear

Of the 4 cohort studies included and rated using the JBI Critical Appraisal Checklist for Cohort Studies (Table 4), 2 had low risk and 2 moderate-high risk. The single case-control study included had low risk of bias according to the rating determined on the JBI Critical Appraisal Checklist for Case-Control Studies (Table 5).

Table 4. JBI Critical Appraisal Checklist for Cohort Studies

	Ahmed 2009	**Chrisman 2017**	**López 2016**	**Salinas 2014**
1. Were the two groups similar and recruited from the same population?	Y	Y	Y	Y
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	Y	N	Y	Y
3. Was the exposure measured in a valid and reliable way?	Y	Y	Y	Y
4. Were confounding factors identified?	Y	Y	Y	U
5. Were strategies to deal with confounding factors stated?	Y	Y	Y	U
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	U	U	N	U
7. Were the outcomes measured in a valid and reliable way?	Y	Y	Y	Y
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	N	Y	Y	Y
9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	Y	N	N	N
10. Were strategies to address incomplete follow up utilized?	NA	N	N	N
11. Was appropriate statistical analysis used?	Y	Y	Y	Y
% of "yes"	73%	64%	73%	54,5%
Risk of bias	Low	Moderate	Low	Moderate

Y=yes, N=no, U=unclear, NA=not-applicable

Table 5. JBI Critical Appraisal Checklist for Case-Control Studies

	Back 2012
1. Were the groups comparable other than the presence of disease in cases or the absence of disease in controls?	Y
2. Were cases and controls matched appropriately?	N
3. Were the same criteria used for identification of cases and controls?	Y
4. Was exposure measured in a standard, valid and reliable way?	Y
5. Was exposure measured in the same way for cases and controls?	Y
6. Were confounding factors identified?	Y
7. Were strategies to deal with confounding factors stated?	Y
8. Were outcomes assessed in a standard, valid and reliable way for cases and controls?	Y
9. Was the exposure period of interest long enough to be meaningful?	Y
10. Was appropriate statistical analysis used?	Y
% of "yes"	90%
Risk of bias	Low

Y=yes, N=no

3.4 *Findings*

3.4.1 Outcomes

Of the primary outcomes observed in the present review, 36 studies investigated hypertension [13–15,28,31,33,38–40,44,46,48–50,53–65,67–70,74,77,78,81,82], 34 assessed type 2 diabetes mellitus [13–15,31,33,34,36–40,43,44,46,50,52,54,56,57,59–61,63–65,67–70,75,77,78,80,82], 40 obesity (BMI≥30kg/m²) [13–15,26,27,29–35,37,40–44,46,47,50–52,54,58,60,61,63–67,70–74,76,78,79], 8 abdominal obesity (waist circumference)) [14,26,39,60,64,65,72,77], 7 low cholesterol HDL [14,37,40,45,60,65,77], 7 high triglycerides [14,34,40,45,60,65,77] and 7 assessed the Metabolic Syndrome [15,40,60,64,65,77]. Of the total studies reviewed, 21 analyzed at least 3 factors of the Metabolic Syndrome [13–15,33,34,37,39,40,44,46,50,54,60,61,63–65,67,70,77,78]. With regard to secondary outcomes, only 2 studies assessed sleep duration [34,44] (Table 6).

Table 6. Outcomes Assessed in Studies Reviewed.

Study ID	Primary Outcomes	Secondary Outcomes
Ahmed, 2009[13]	HTN; DM; obesity	
Albrecht, 2013[26]	Obesity; AO	
Altman, 2017[27]	Obesity	
Angel, 2008[28]	HTN	
Antecol, 2006[29]	Obesity	
Anzman-Frasca, 2016[30]	Obesity	
Back, 2012[82]	HTN; DM	
Beltrán-Sánchez, 2016[14]	HTN; DM; obesity; AO; low HDL; high TGL; MetS	
Boggess, 2016[31]	HTN; DM; overweight or obesity	
Briones, 2016[76]	Obesity	
Caspi, 2017[32]	Obesity	
Castañeda, 2015[33]	HTN; DM; obesity	
Chakraborty, 2003[34]	DM; obesity; high TGL	Sleep duration
Choi, 2012[35]	Obesity	
Chrisman, 2017[79]	Obesity	
Coffman, 2012[36]	DM	
Cohn, 2017[68]	HTN; DM	
Davis, 2007[37]	DM; obesity; low HDL	
Dawson, 2019[67]	HTN; DM; obesity	
Del Brutto, 2013[69]	HTN; DM	
Elfassy, 2018[38]	HTN; DM	
Gany, 2016[39]	HTN; DM; AO	
Gill, 2017[40]	HTN; DM; obesity; low HDL; high TGL; MetS	
Giuntella, 2017[41]	Obesity	
Glick, 2015[42]	Obesity	
Heer, 2013[75]	DM	
Hubert, 2005[15]	HTN; DM; obesity; MetS (2 or 3 factors)	
Iten, 2014[43]	DM; obesity	
Jackson, 2014[44]	HTN; DM2; obesity	Sleep duration

Study ID	Primary Outcomes	Secondary Outcomes
Jaranilla, 2014[45]	Low HDL; high TGL	
Jerome-D'Emilia, 2014[46]	HTN; DM2; obesity	
Klabunde, 2020[47]	Obesity	
LeBrón, 2020[48]	HTN	
Li, 2017[49]	HTN	
Lopez-Cevallos, 2019[70]	HTN; DM2; obesity	
López, 2016[80]	DM2	
López, 2019[50]	HTN; DM2; obesity	
Martínez, 2014[51]	Obesity	
McClure, 2010[52]	Obesity; DM2	
Narang, 2020[53]	HTN	
Nelson, 2007[77]	HTN; DM2; AO; low HDL, high TGL; MetS	
Pickering, 2007[71]	Obesity	
Rodriguez, 2012[54]	HTN; DM2; obesity	
Rodriguez, 2020[72]	Obesity; AO	
Ryan, 2006[55]	HTN	
Saint-Jean, 2005[56]	HTN; DM2	
Salinas, 2014[81]	HTN	
Shelley, 2011[57]	HTN; DM2	
Shi, 2015[58]	HTN; obesity	
Singh-Franco, 2013[59]	HTN; DM2	
Slattery, 2006[73]	Obesity	
Tehranifar, 2015[60]	HTN; DM2; obesity; AO; low HDL; high TGL; MetS	
Torres, 2018[74]	HTN; obesity	
Vaeth, 2005[78]	HTN; DM2; obesity	
Villarejo, 2010[61]	HTN; DM2; obesity	
Viruell-Fuentes, 2012[62]	HTN	
Wassink, 2017[63]	HTN; DM2; obesity	
Weigel, 2019[64]	HTN; DM2; obesity; AO; MetS	
Weigel, 2007[65]	HTN; DM2; obesity; AO; low HDL; high TGL; MetS	
Wolin, 2009[66]	Obesity	

HTN=Hypertension; DM2=Type 2 diabetes mellitus; AO=Abdominal obesity; HDL=High Density Lipoprotein; TGL=Triglycerides; MetS=Metabolic Syndrome.

3.4.1.1 Arterial Hypertension or High Blood Pressure

Of the 36 studies that assessed arterial hypertension, 24 performed blood pressure measurements [13,14,28,31,33,38–40,48,50,53,57,59–61,63–65,67,69,74,77,78,82], 11 collected information based on self-reports [15,44,46,49,54,56,58,62,68,70,81], and 1 employed both methods [55].

The prevalence of arterial hypertension or high blood pressure found in the studies reviewed in latinos was 28% (95%CI 23%-33%, I2 99.6%). Of the studies included in the meta-analysis, 23 were heterogeneous (Figure 2). Within this group, some studies

[15,39,50,53,68,70,78,82] differed more with respect to population size, measurement approach (objective or subjective), design (1 case-control study) and characteristics of the population (ethnicity, age and country of origin).

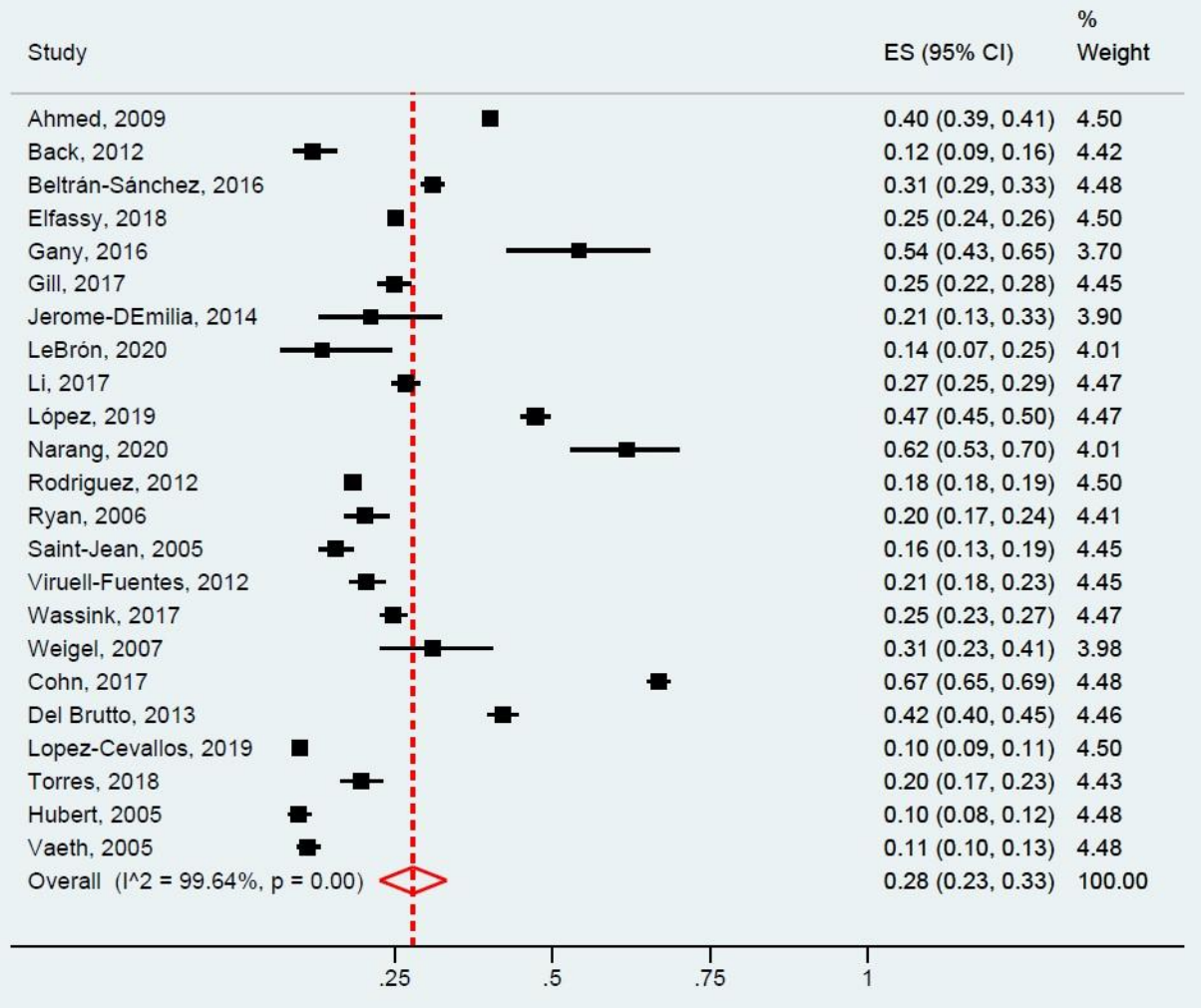


Figure 2. Arterial hypertension or high blood pressure in latinos

Additionally, a meta-analysis on the prevalence of arterial hypertension or high blood pressure for non-US-born latinos (immigrants) and US-born latinos was carried out (Figure 3). Slightly higher prevalence was found for US-born latinos (32% (95%CI 19%-45%, I2 99.7%)), than for immigrant latinos (28% (95%CI 22%-33%, I2 99.3%)). The 7 studies of immigrant latinos and 4 of US-born latinos included in the meta-analysis were heterogeneous. Greater differences were identified in 2 studies for immigrant latinos[39,54] and 2 for US-born immigrants [13,54], possibly explained by population size, study design or outcome measurement method.

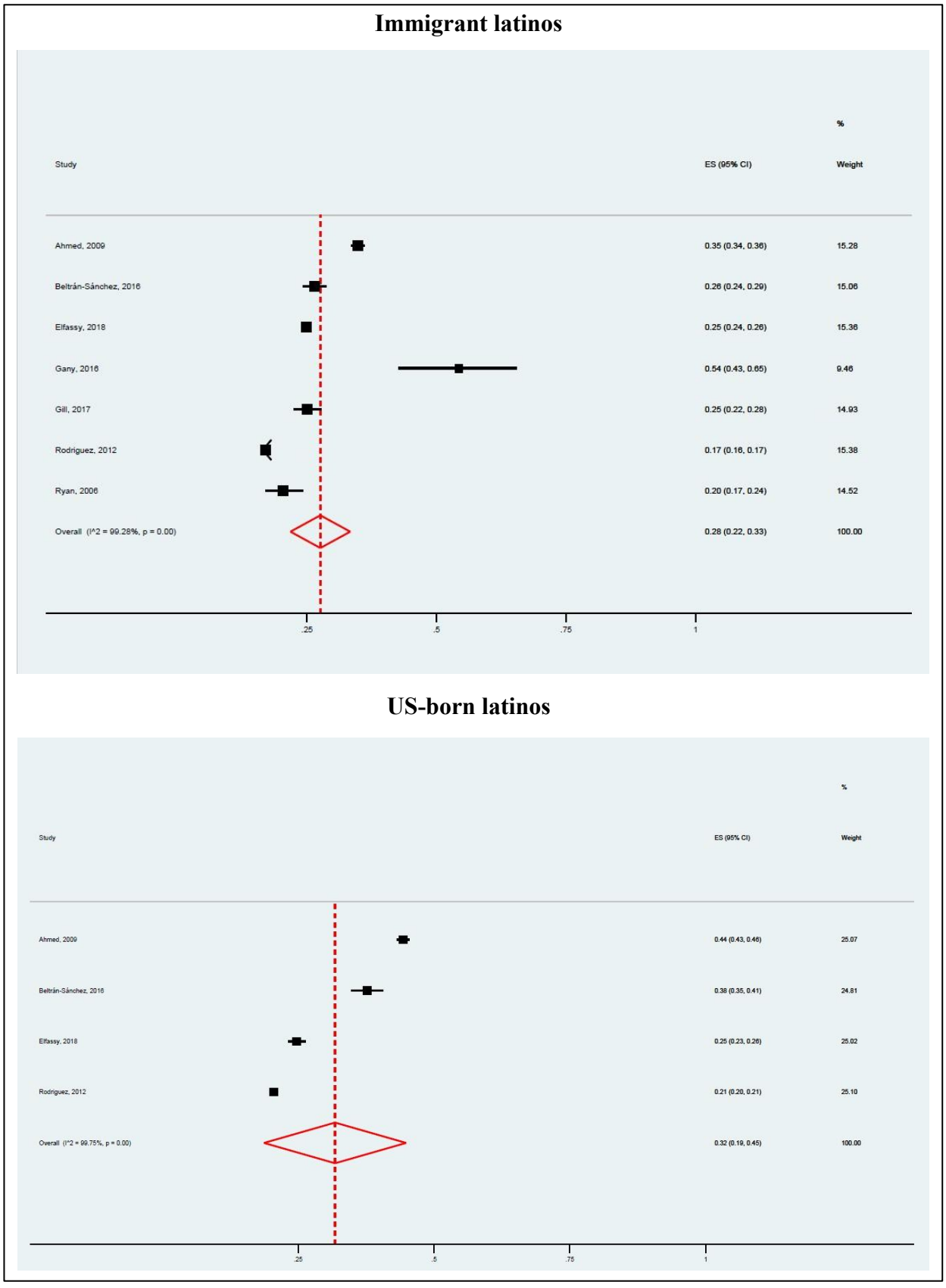


Figure 3. Arterial hypertension or high blood pressure in immigrant latinos and US-born latinos

3.4.1.2 Type 2 Diabetes Mellitus or High Blood Glucose

Of the 34 studies which evaluated type 2 diabetes mellitus or high blood glucose, 21 analyzed blood samples to determine glucose levels [13,14,31,34,37–40,43,50,52,57,59–61,63–65,77,80,82], while 13 collected this information via interviews (self-report) [15,33,36,44,46,54,56,67–70,75,78].

A total of 24 studies were included in the meta-analysis of the prevalence of type 2 diabetes mellitus or high blood glucose (Figure 4), although these were heterogeneous. The prevalence of these conditions in latinos was 17% (95%CI 14%-20%, I2 99.3%). Notably, a number of studies [15,37,39,43,52,65,70,78,80,82] exhibited greater heterogeneity compared to the others in terms population size, outcome measurement method, study design and country of origin of immigrant latinos.

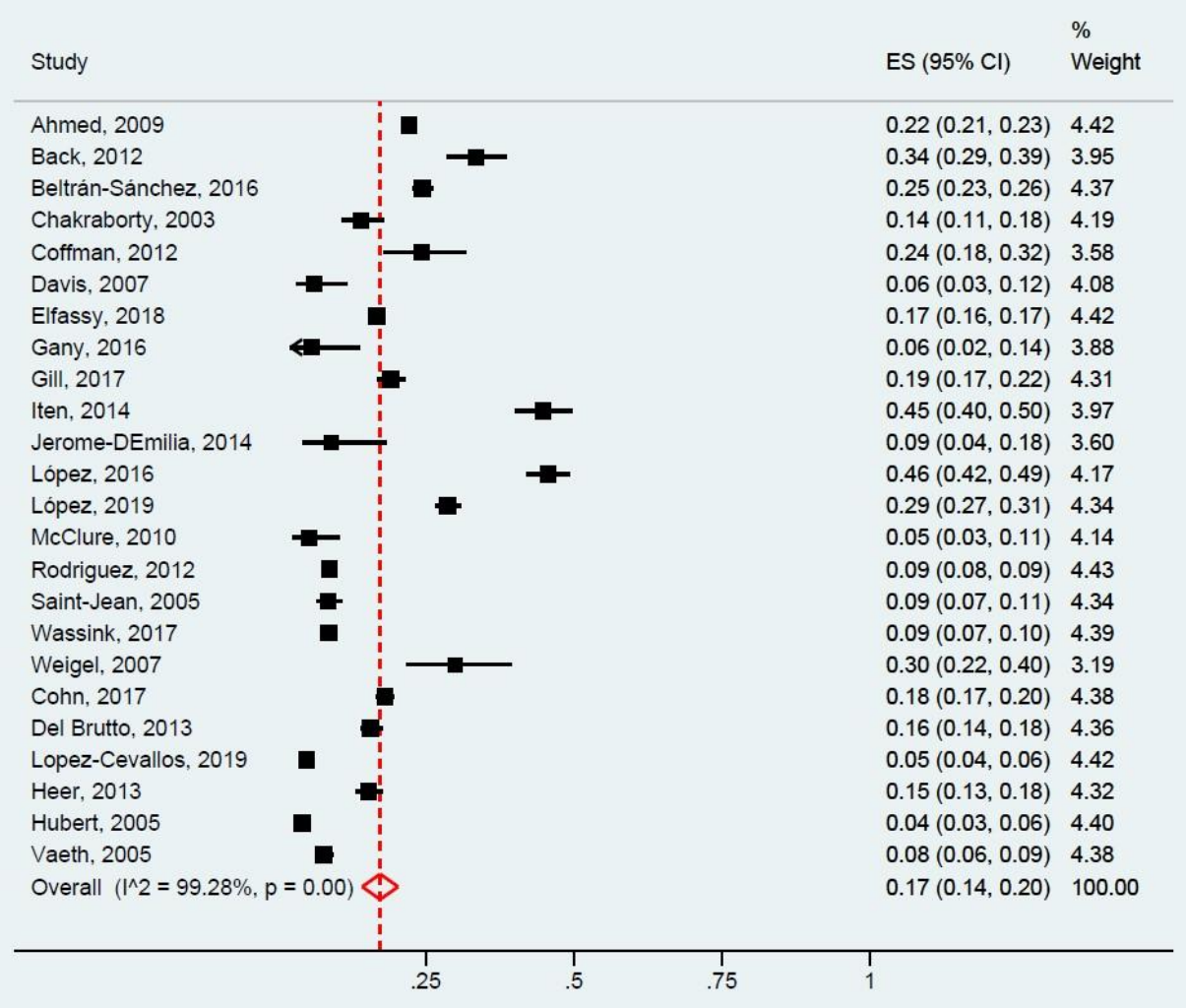


Figure 4. Type 2 Diabetes Mellitus or high blood glucose in latinos

In the further analyses, a meta-analysis of the prevalence of type 2 diabetes mellitus or high blood glucose was conducted of 7 studies for immigrant latinos and 5 for US-born latinos (Figure). However, population size and outcome measurement methods differed in 3 of the

studies for immigrant latinos [39,43,54] and 3 for US-born latinos [38,43,54]. A higher prevalence of the conditions was found for US-born latinos (25% (95%CI 16%-33%, I2 99.6%)) compared to immigrant latinos (19% (95%CI 14%-24%, I2 99.3%).

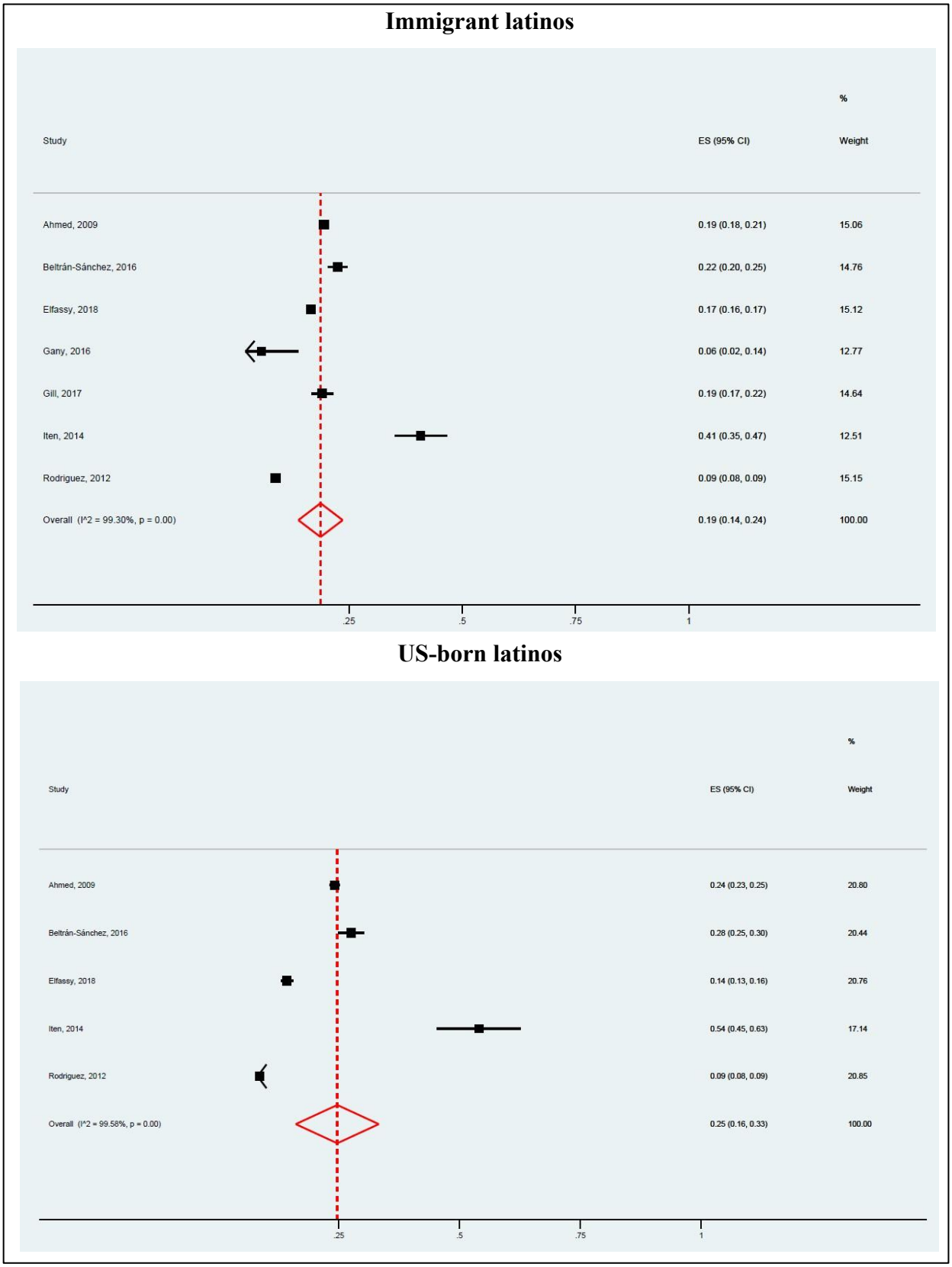


Figure 5. Type 2 Diabetes Mellitus or high blood glucose in immigrant latinos and US-born latinos

3.4.1.3 General Obesity and Abdominal Obesity

Of the 41 studies assessing general obesity (BMI ≥ 30Kg/m²), 26 collected measurements of weight and height of participants[13,14,26,27,30–34,37,40,43,46,50–52,60,61,63–67,72–74] (1 study classified participants as "overweight or obese"[31], based on a BMI ≥ 25Kg/m²), 12 obtained the parameters from self-reports [15,29,35,41,44,47,54,58,70,71,76,79], while 2 studies employed both collection methods[42,78]. All 8 studies assessing abdominal obesity performed waist circumference measurements.

For general obesity, the 28 studies included in the meta-analysis (Figure 6) were heterogeneous, revealing a general obesity rate of 37%(95%CI 34%-40%, I2 99.6%) in latinos. A total of 11[15,29,34,35,37,43,54,65,66,70,74] studies showed greater heterogeneity, particularly for population sample size and characteristics (age and country of origin), and outcome measures.

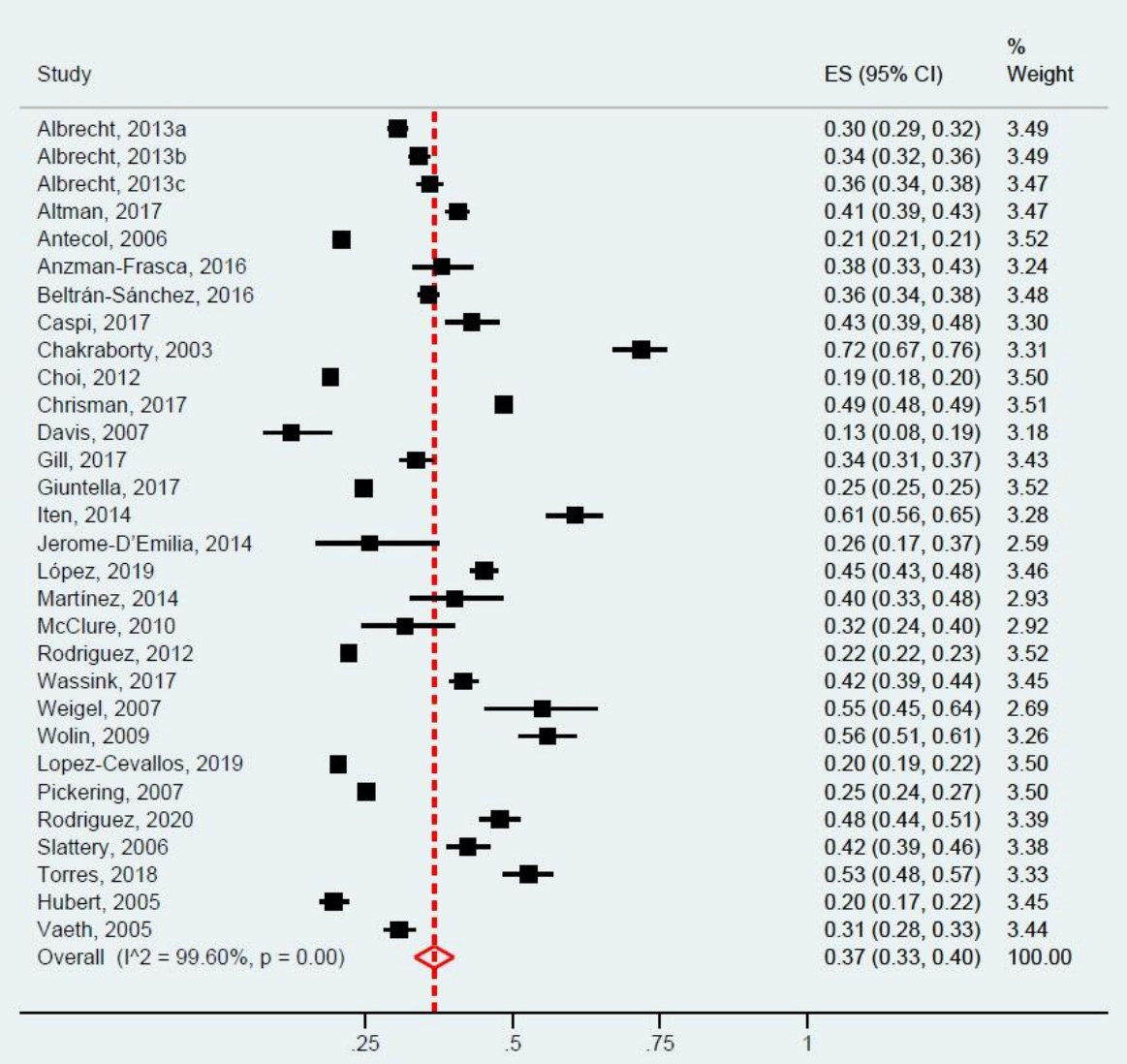


Figure 6. General obesity in latinos

For abdominal obesity, the prevalence for latinos determined by the meta-analysis of 5 studies was 54% (95CI% 48%-59%, I2 96.7%). Notably, all 5 of these studies included in the meta-analysis were heterogeneous (Figure 7).

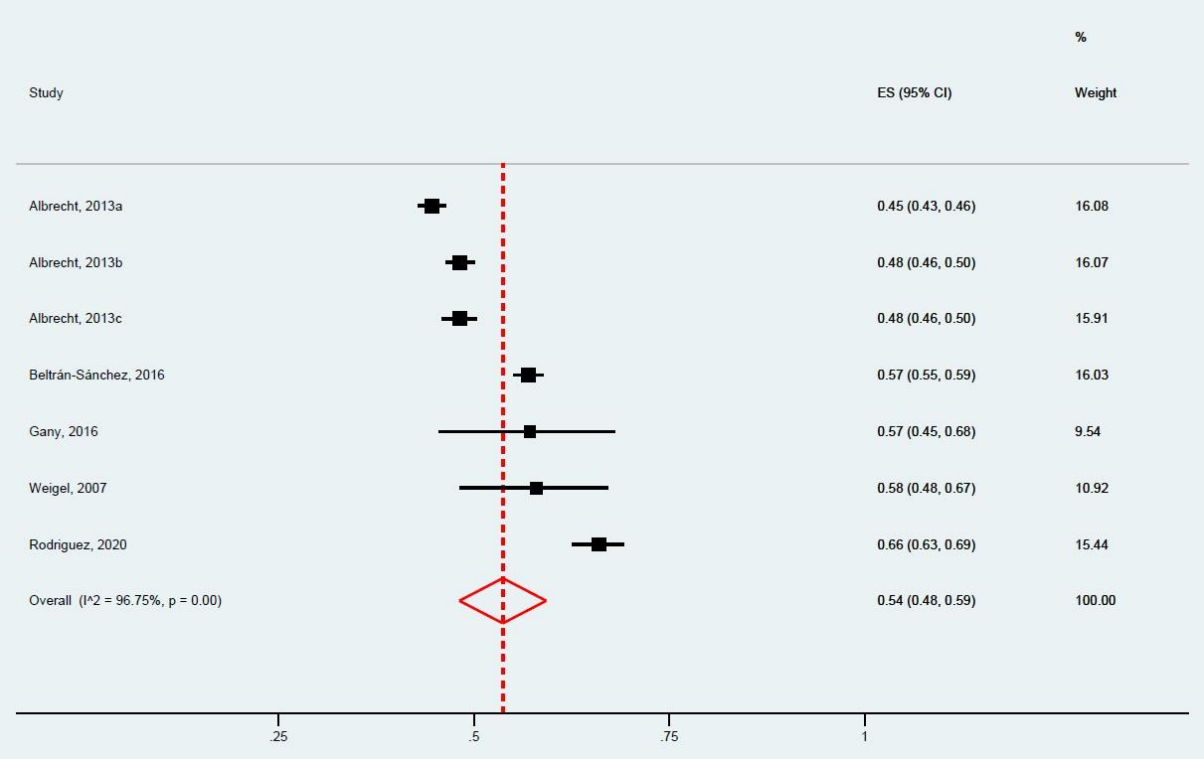
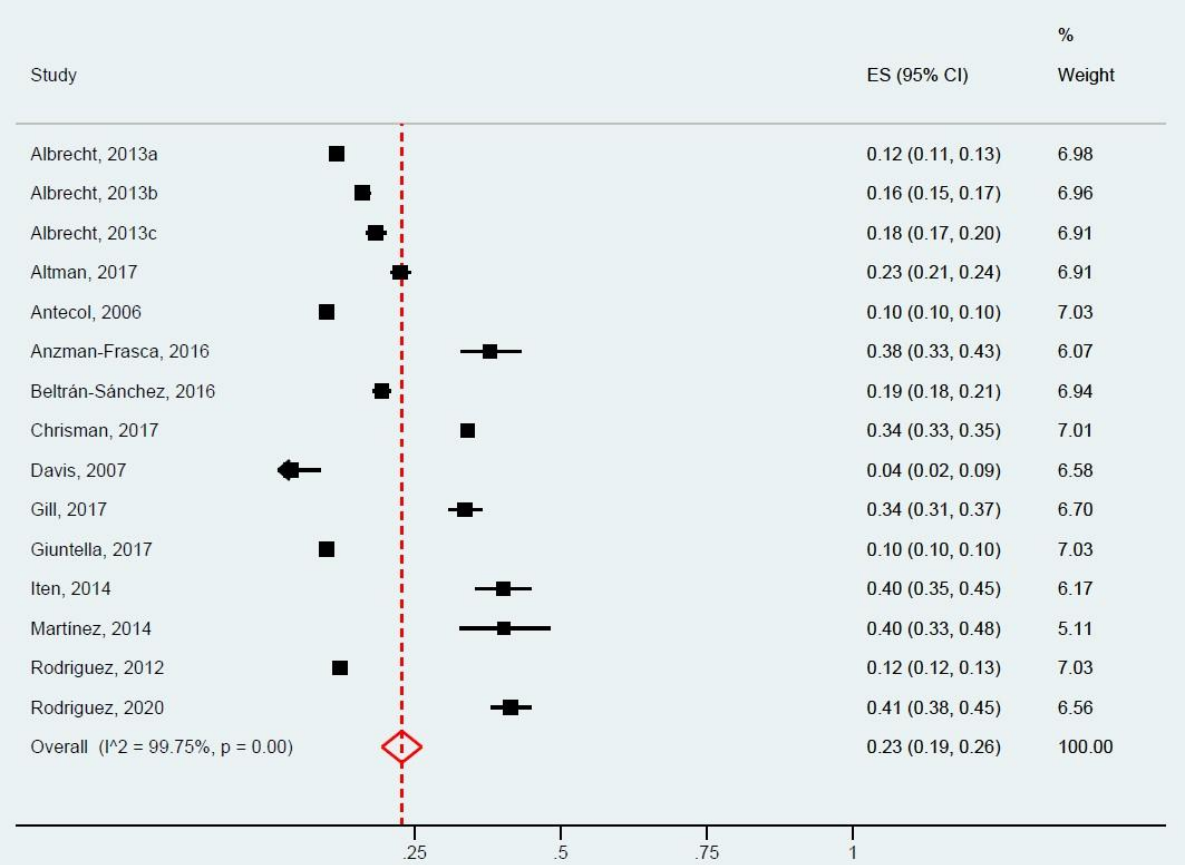


Figure 7. Abdominal obesity in latinos

In the further analyses of general obesity rates in immigrant latinos and US-born latinos, 13 studies were included in the meta-analysis for immigrants and 10 for US-born latinos (Figure 8). A higher prevalence of general obesity was observed in immigrants (23% (95%CI 19%-26%, I2 99.7%)) compared to US-born latinos (15% (95%CI 13%-16%, I2 99%)). All of the articles included in the meta-analysis involving immigrants, as well as those in US-born immigrants, were heterogeneous. However, 5 studies of immigrant latinos [30,37,43,51,72] and 1 of US-born latinos [72] exhibited greater heterogeneity for population size and characteristics (age and country of origin).

Immigrant latinos



US-born latinos

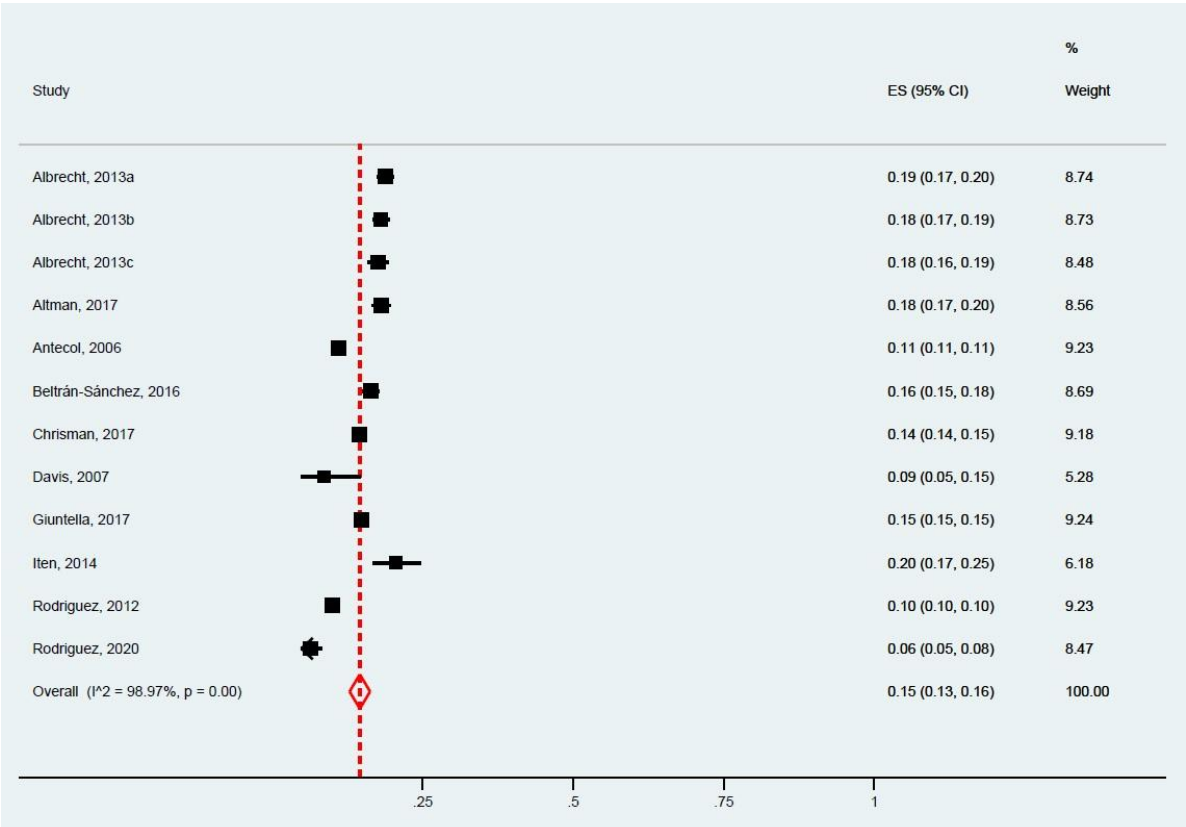


Figure 8. General obesity in immigrant latinos and US-born latinos

3.4.1.4 HDL Cholesterol and Triglycerides

All studies that determined HDL cholesterol HDL (7) and triglycerides (7) collected data through blood workups.

Five studies were included in the meta-analysis of the prevalence of low HDL cholesterol in latinos (Figure 9), revealing a prevalence of 42% (95%CI 35%-49%, I2 92.2%). The studies were heterogeneous, possibly due to the different sample sizes investigated.

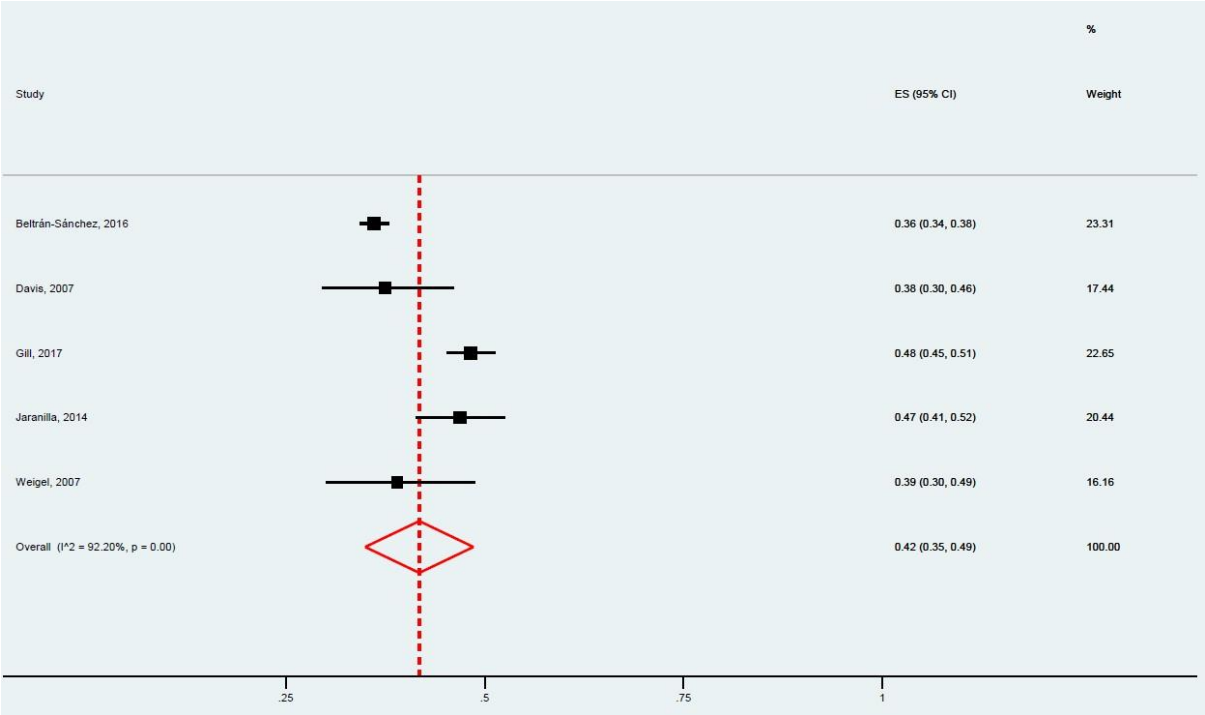


Figure 9. Low HDL cholesterol in latinos

For high triglycerides, the 5 studies included in the meta-analysis were also heterogeneous (Figure 10). Two of the studies [34,65] differed more for population size and country of origin of immigrant latinos. The prevalence of high triglycerides in latinos was 38% (95%CI 24%-51%, I2 98.6%).

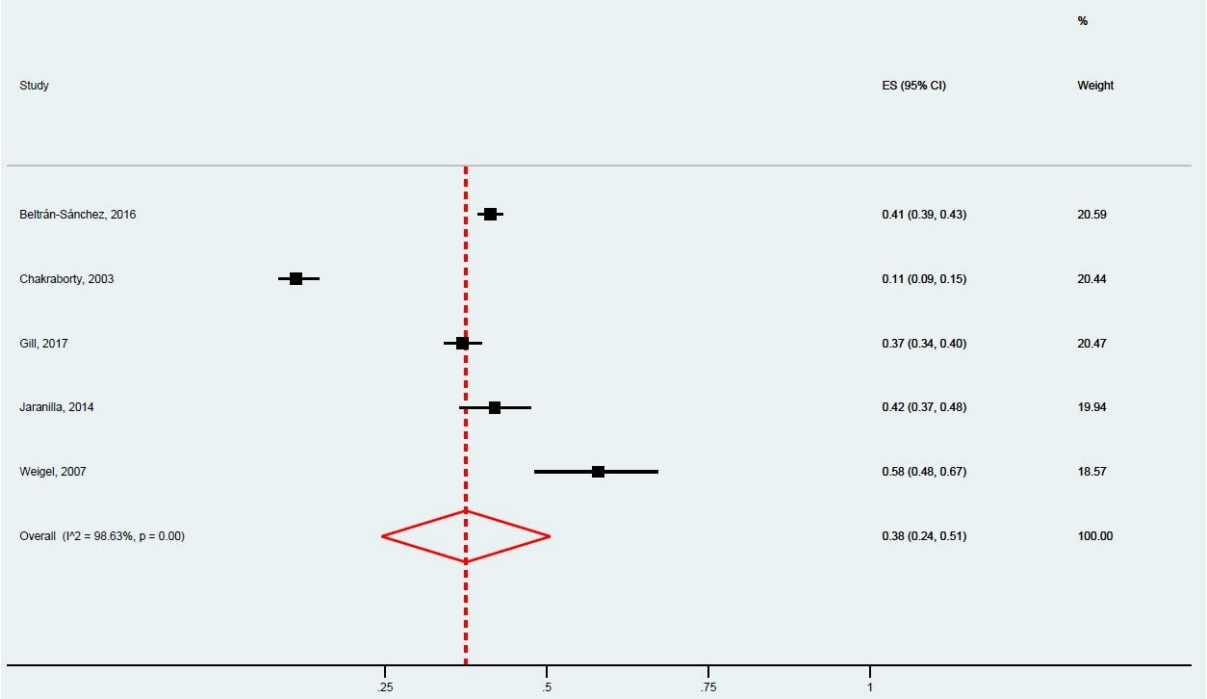


Figure 10. High triglycerides in latinos

3.4.1.5 Metabolic Syndrome

Of the 7 studies assessing the Metabolic Syndrome, 6 used objective measures for obtaining data 15 [40,60,64,65,77], while 1 collected data using auto-reports [15].

Despite the greater heterogeneity of 2 studies [40,65], attributed to population size and country of origin of immigrant latinos, these were included (together with 3 other studies) in the meta-analysis of prevalence rate of the Metabolic Syndrome in latinos (Figure 11), whose results showed a prevalence of 39% (95%CI 32%-45%, I2 93.2%).

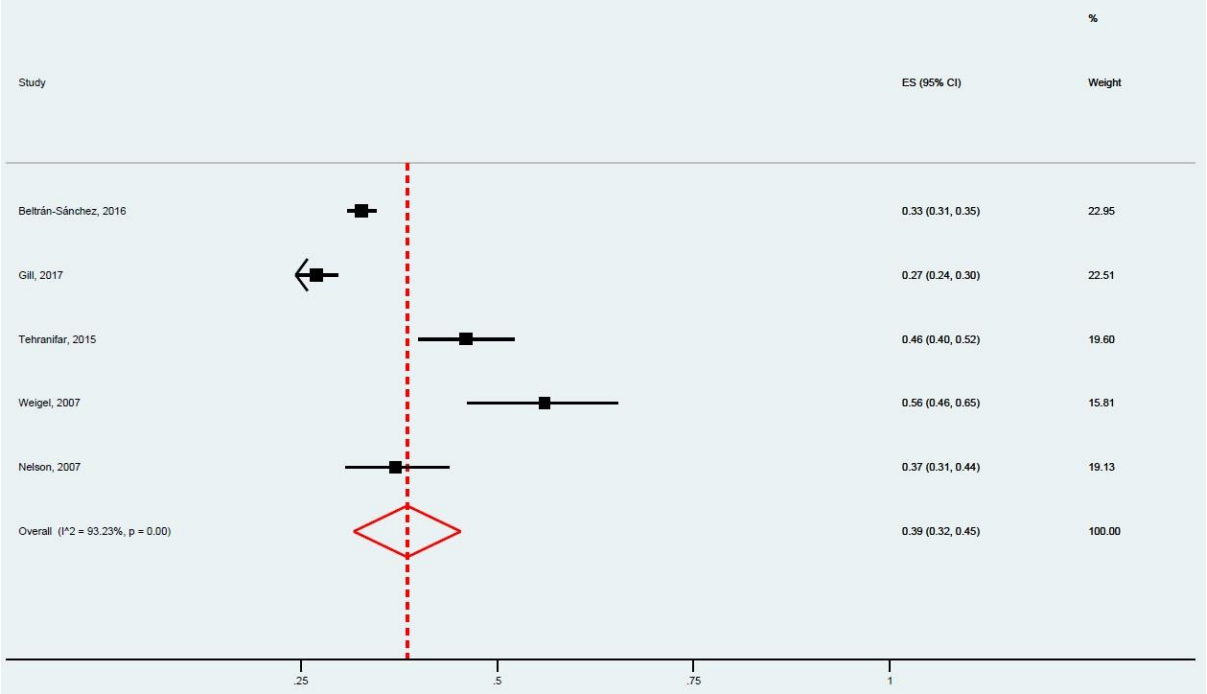


Figure 11. Metabolic Syndrome in latinos

3.4.2 Quality of Evidence

After applying the GRADE system criteria, the categories risk of bias (heterogeneity) and imprecision were downgraded by 1 point for the outcomes arterial hypertension, type 2 diabetes mellitus, general obesity and abdominal obesity. Publication bias was not downgraded, not even for indirect evidence, given that the surrogate outcomes observed (high blood pressure and glucose, and BMI and waist measures) are strongly associated with the outcomes of interest.

The quality of evidence on the assessment of high triglycerides and low HDL cholesterol were downgraded by 1 point for risk of bias, inconsistency (heterogeneity) and publication bias, and by 2 points for imprecision, because few studies assessing these outcomes were found. Most of these studies showed major differences in sample size and broad confidence intervals on the meta-analysis. No downgrades for indirect evidence were made, since no surrogate outcomes were identified.

For the metabolic syndrome, the risk of bias and publication bias categories were each downgraded by 1 level, whereas the inconsistency (heterogeneity) and imprecision categories were each downgraded by 2 levels. The quality of evidence was downgraded for publication bias because few studies were found assessing the metabolic syndrome in immigrant latinos, a factor which may have led to overestimation of the measure.

The studies included in the review were expected to be heterogeneous chiefly owing to the cultural disparities (dietary habits and different lifestyles) among immigrant populations. These differences can impact the development of the outcomes observed, where this was confirmed by I2 results exceeding 90%. Other factors such as socioeconomic differences, migration status, education, acculturation and length of residence in the USA can also affect heterogeneity. These factors, however, could not be explored further in the present review because few studies reported these characteristics.

The downgrading of quality by 1 level due to risk of bias for all outcomes observed was based on the individual assessment of risk of bias by the JBI.

In conclusion, the quality of evidence for the outcomes of interest of this systematic review and meta-analysis was defined as low for systemic arterial hypertension, type 2 diabetes mellitus, general obesity and abdominal obesity, and as very low for high triglycerides, low HDL cholesterol and metabolic syndrome. It is likely that further research would have a material impact on this conclusion and probably alter it.

4. **Discussion**

4.1 *Summary of Evidence*

A total of 60 studies were included in this systematic review, of which 52 were included in the meta-analysis. The overall population of the 52 studies was 436,654 immigrant latinos in the USA. The pooled prevalence obtained for arterial hypertension, type 2 diabetes mellitus, general obesity and abdominal obesity were 28% (95%CI 23%-33%), 17% (95%CI 14%-20%), 37% (95%CI 33%-40%) and 54% (95%CI 48%-59%), respectively (Table 7). The prevalence for the other outcomes was not presented because of uncertainty over the results found for these outcomes in immigrant latinos, whose quality of evidence rating was very low.

Table 7. Summary of Findings.

Systematic Review of the Metabolic Syndrome and its Components in US immigrants

Population: Latin American immigrants ≥ 18 years old
Settings: USA
Exposure: Immigration
Comparator: US born population

Outcomes	Prevalence estimate (%) (95% CI)	No. of Latino participants (studies)	GRADE evidence level	Comments
Hypertension	28 (23-33)	84.047	⊕⊕⊖⊖[a,b,c,g,h] Low	The available evidence is sufficient to determine the prevalence, but confidence in the estimate is constrained. As more information becomes available, the observed prevalence could change, and this change may be large enough to alter the conclusion.
Type 2 Diabetes Mellitus	17 (14-20)	83.423	⊕⊕⊖⊖[a,b,c,g,h] Low	The available evidence is sufficient to determine the prevalence, but confidence in the estimate is constrained. As more information becomes available, the observed prevalence could change, and this change may be large enough to alter the conclusion.
Obesity (BMI>30kg/m²)	37 (33-40)	237.035	⊕⊕⊖⊖[a,b,c,g,h] Low	The available evidence is sufficient to determine the prevalence, but confidence in the estimate is constrained. As more information becomes available, the observed prevalence could change, and this change may be large enough to alter the conclusion.
Abdominal Obesity	54 (48-59)	20.073	⊕⊕⊖⊖[a,b,c,g,h] Low	The available evidence is sufficient to determine the prevalence, but confidence in the estimate is constrained. As more information becomes available, the observed prevalence could change, and this change may be large enough to alter the conclusion.
High Triglycerides	-[x]	4.867	⊕⊖⊖⊖[a,b,d,f,h] Very Low	The available evidence is insufficient to determine a reliable prevalence, and confidence in the estimate is constrained. More information may allow a more accurate estimation.
Low HDL-c	-[x]	4.605	⊕⊖⊖⊖[a,b,d,f,h] Very Low	The available evidence is insufficient to determine a reliable prevalence, and confidence in the estimate is constrained. More information may allow a more accurate estimation.
Metabolic Syndrome	-[x]	2.604	⊕⊖⊖⊖[a,d,e,f,h] Very Low	The available evidence is insufficient to determine a reliable prevalence, and confidence in the estimate is constrained. More information may allow a more accurate estimation.

CI: confidence interval
GRADE quality of evidence ratings
High quality: We are very confident that the effect in the study reflects the actual effect.
Moderate quality: We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different.
Low quality: The true effect may differ significantly from the estimate.
Very low quality: The true effect is likely to be substantially different from the estimated effect.

[x] Because we are very uncertain about the effect estimate, we do not present it in this summary of findings table.
[a] Downgraded by one level (-1) for serious concerns for risk of bias.
[b] Downgraded by one level (-1) for serious concerns for inconsistency.
[c] *Downgrade by one level (-1) for serious concerns for imprecision.*
[d] *Downgrade by two levels (-2) for very serious concerns for imprecision.*
[e] Downgraded by two levels (-2) for very serious concerns for inconsistency.
[f] *Downgrade by one level (-1) for serious concerns for publication bias.*
[g] *The observed surrogate endpoints are strongly associated with the outcome, so we did not reduce the evidence.*
[h] Most of the included studies are cross-sectional, which may lead to further reduction in the quality of the evidence.

Higher prevalence for the outcomes arterial hypertension or high blood pressure and type 2 diabetes mellitus or high blood glucose were found in US-born latinos relative to immigrant latinos. By contrast, the prevalence for general obesity was higher in immigrants. Data from the CDC[12] shows an alarming rise in obesity, hypertension and diabetes in the latino population. The finding of higher prevalence of obesity in immigrants lends support to the notion of increased weight in this group as the result of the accelerated process of nutrition transition occurring in many countries of Latin America and other developing countries, and of exposure to a highly obesogenic environment like the USA, factors which should be taken into account in studies on the issue [37,51].

Comparison of the prevalence found in the meta-analysis with those of the CDC for the latino population in 6 main states with the largest concentration of latino and Brazilians according to the 2019 ACS census [83] (Florida, Massachusetts, New Jersey, New York, California and Connecticut), revealed higher prevalence on the meta-analysis compared with 2019 CDC data[12] for hypertension (CDC prevalence range 22.4%-27.4%), diabetes (CDC range 8.3-13.9%) and high cholesterol (CDC range 27.3%-31.8% - based on meta-analysis rates for triglycerides and HDL cholesterol). Regarding 2020 CDC prevalence [12] for general obesity (range 27.1%-41.4%), the prevalence found on the meta-analysis was similar, proving lower only for the rate observed in California.

4.2 *Comparison against Evidence from Previous Systematic Reviews and Meta-Analyses*

To the best of our knowledge, there have been no previous systematic reviews or meta-analyses assessing factors involved in metabolic syndrome in immigrant latinos within the USA, precluding any meaningful comparisons. However, 2 systematic reviews assessing obesity alone [16,17] in immigrant populations have been conducted.

These reviews suggested a possible relationship of higher level of acculturation, sex, nativity, length of residence in the USA and generational status of immigrants with increased obesity. Nevertheless, the prevalence of obesity in this population was not addressed in these reviews, preventing any comparisons with the obesity data found in the present review and meta-analysis.

The review by Delavari et al. [16] explored the relationship between acculturation and overweight/obesity in adult immigrants from low and middle-income countries. Overall, of the 9 studies reviewed, 7 identified a positive association between level of acculturation and bodyweight variables.

Among the studies reviewed by these authors involving immigrant latino populations (Mexican-Americans) in the USA, significant differences in acculturation level, sex, nativity, length of residence in the country and generational status of immigrants with BMI were evident.

The cited review [16] showed that higher levels of acculturation were associated with greater BMI in immigrant latinos, and also identified an association of sex, immigrant generational status, and nativity with increased obesity. On the analyses stratified by sex, women immigrants residing in the USA for over 15 years had a mean BMI that was 2.38 kg/m² greater than the average found for women with less than 5 years of residence. A similar result was found for men living in the USA for over 15 years compared with those residing in the country for less than 5 years (1.10 kg/m² higher mean BMI in former group). On the assessment of risk of developing obesity associated with increased level of acculturation, the review found a 4% and 3% higher risk of obesity in immigrant men and women with a high level of acculturation, respectively.

With regard to the generational status of immigrants, the review of Delavari et al [16] found that second and third generations of Mexican-American had higher BMIs than their first generation counterparts.

The review by Oza-Frank and Cunningham [17] investigated the relationship between length of residence of immigrants in the USA and BMI. For the majority of the studies reviewed, the authors identified a positive association between time of residence in the USA and BMI. Among the results, some of the studies showed that a length of residence of up to 10 years promoted no major change in BMI of immigrants, whereas others identified peak BMI growth after 21 years of residence for men and 15 years for women.

The same review [17] included 4 studies involving immigrant latinos, all of which reported a significant association between BMI and length of residence in the USA.

4.3 *Limitations*

The present systematic review and meta-analysis has some limitations. First of these is the high statistical heterogeneity observed for all outcomes. Immigrant populations differ in many ways, e.g. country of origin, migration status, degree of acculturation, educational and socioeconomic level, and these differences might explain the high inconsistency found. Thus, the pooled estimates presented in this study should be regarded as indicative as opposed to conclusive.

Second, most of those studies reviewed specifying the origin of the immigrant latino population included only immigrants from Mexico or Central America. As a result, much of the evidence found in the review is constrained to a subpopulation of immigrants from Latin America. There is scant scientific evidence on components of the metabolic syndrome in immigrants from countries of South America. Consequently, the evidence found in this review and meta-analysis may not be representative of these countries, which exhibit major sociocultural and economic differences that can impact the development of chronic diseases.

Third, it was not possible to stratify analyses for other key characteristics, such as sex, age, country of birth, length of residence in the USA, migration status, occupation and health insurance, because not all studies reported the detailed information needed to calculate estimates.

Fourth, some studies reported results for more than one outcome of interest. However, it was not possible to extract information for all outcomes in some cases, as not all studies held the data needed.

Fifth, some studies used measures derived from self-reports, particularly for general obesity, which are known to be subject to information bias, typically leading to an underestimation of own weight by women and overestimation by men [84].

Lastly, the studies were pooled in the meta-analyses, irrespective of risk of individual bias associated with them, in order to prevent selection bias in meta-analyses due to stratification by quality of study [85].

5. **Conclusions**

This systematic review and meta-analysis was conducted in collaboration with researchers from the USA and Brazil to compile the available evidence on the metabolic syndrome and its risk factors in the immigrant latino population. A large body of evidence was identified encompassing numerous studies, particularly pertaining to hypertension, type 2 diabetes and both general and abdominal obesity. However, the evidence was classified as low or very low depending on the outcome. This rating suggests that future reviews and meta-analysis may reach different conclusions, when more studies assessing the metabolic syndrome and its components become available, particularly HDL cholesterol and triglycerides, factors which featured less in the studies reviewed.

The pooled prevalence obtained was 28% (95%CI 23%-33%) for arterial hypertension, 17% (95%CI 14%-20%) for type 2 diabetes mellitus, 37% (95%CI 33%-40%) for general obesity

and 54% (95%CI 48%-59%) for abdominal obesity. Greater prevalence of arterial hypertension and type 2 diabetes mellitus were found for US-born latinos, while general obesity rates were higher for immigrant latinos.

The production of prevalence estimates of the metabolic syndrome and its risk factors in the immigrant population appears to be justified and evidence-based, considering the cultural, dietary and lifestyle differences encountered by migrants, which promote increased obesity (strongly associated with the metabolic syndrome) and chronic diseases associated with the condition.

However, few studies were available that included, or analyzed separately, information on immigrant latinos from South America, including Brazil, a region for which only 2 studies were identified. Therefore, further studies are needed addressing the metabolic syndrome and its factors in immigrants from South America, particularly Brazil, in view of the particularities regarding the culture, language and diet in the country compared to other Latin American nations.

References

1. Omran, A.R. The Epidemiologic Transition: A Theory of the Epidemiology of Population Change: *The Epidemiologic Transition*. *Milbank Quarterly* **2005**, *83*, 731–757, doi:10.1111/j.1468-0009.2005.00398.x.

2. *Obesity: Preventing and Managing the Global Epidemic: Report of a WHO Consultation*; WHO, Ed.; WHO technical report series; World Health Organization: Geneva, 2000; ISBN 978-92-4-120894-9.

3. WHO Obesity and Overweight Available online: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

4. Zimmet, P.; Magliano, D.; Matsuzawa, Y.; Alberti, G.; Shaw, J. The Metabolic Syndrome: A Global Public Health Problem and a New Definition. *J. Atheroscler. Thromb.* **2005**, *12*, 295–300.

5. Hruby, A.; Hu, F.B. The Epidemiology of Obesity: A Big Picture. *PharmacoEconomics* **2015**, *33*, 673–689, doi:10.1007/s40273-014-0243-x.

6. Reaven, G.M. Role of Insulin Resistance in Human Disease. *Diabetes* **1988**, *37*, 1595–1607, doi:10.2337/diab.37.12.1595.

7. NCEP Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) Final Report. *Circulation* **2002**, *106*, 3143–3421.

8. Grundy, S.M.; Cleeman, J.I.; Daniels, S.R.; Donato, K.A.; Eckel, R.H.; Franklin, B.A.; Gordon, D.J.; Krauss, R.M.; Savage, P.J.; Smith, S.C.; et al. Diagnosis and Management of the Metabolic Syndrome: An American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. *Circulation* **2005**, *112*, 2735–2752, doi:10.1161/CIRCULATIONAHA.105.169404.

9. WHO Definition, Diagnosis and Classification of Diabetes Melittus and Its Complications. Part 1: Diagnosis and Classification of Diabetes Melittus 1999.

10. Shi, T.H.; Wang, B.; Natarajan, S. The Influence of Metabolic Syndrome in Predicting Mortality Risk Among US Adults: Importance of Metabolic Syndrome Even in Adults With Normal Weight. *Prev. Chronic Dis.* **2020**, *17*, 200020, doi:10.5888/pcd17.200020.

11. Malik, V.S.; Willett, W.C.; Hu, F.B. Global Obesity: Trends, Risk Factors and Policy Implications. *Nat Rev Endocrinol* **2013**, *9*, 13–27, doi:10.1038/nrendo.2012.199.

12. CDC BRFSS Prevalence & Trends Data Available online: https://www.cdc.gov/brfss/brfssprevalence/.

13. Ahmed, A.T.; Quinn, V.P.; Caan, B.; Sternfeld, B.; Haque, R.; Van Den Eeden, S.K. Generational Status and Duration of Residence Predict Diabetes Prevalence among Latinos: The California Men's Health Study. *BMC Public Health* **2009**, *9*, doi:10.1186/1471-2458-9-392.

14. Beltrán-Sánchez, H.; Palloni, A.; Riosmena, F.; Wong, R. SES Gradients Among Mexicans in the United States and in Mexico: A New Twist to the Hispanic Paradox? *Demography* **2016**, *53*, 1555–1581, doi:10.1007/s13524-016-0508-4.

15. Hubert, H.; Snider, J.; Winkleby, M. Health Status, Health Behaviors, and Acculturation Factors Associated with Overweight and Obesity in Latinos from a Community and Agricultural Labor Camp Survey. *Preventive Medicine* **2005**, *40*, 642–651, doi:10.1016/j.ypmed.2004.09.001.

16. Delavari, M.; Sønderlund, A.L.; Swinburn, B.; Mellor, D.; Renzaho, A. Acculturation and Obesity among Migrant Populations in High Income Countries--a Systematic Review. *BMC Public Health* **2013**, *13*, 458, doi:10.1186/1471-2458-13-458.

17. Oza-Frank, R.; Cunningham, S.A. The Weight of US Residence among Immigrants: A Systematic Review. *Obes Rev* **2010**, *11*, 271–280, doi:10.1111/j.1467-789X.2009.00610.x.

18. Monteiro, C.A.; Mondini, L.; de Souza, A.L.; Popkin, B.M. The Nutrition Transition in Brazil. *Eur J Clin Nutr* **1995**, *49*, 105–113.

19. Brasil Ministério Da Saúde. Secretaria de Vigilância Em Saúde. Vigitel Brasil: Vigilância de Fatores de Risco e Proteção Para Doenças Crônicas Por Inquérito Telefônico. Publicações 2010-2020 2022.

20. United States Census Bureau Hispanic or Latino Origin Available online: https://www.census.gov/acs/www/about/why-we-ask-each-question/ethnicity/.

21. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; et al. The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews. *BMJ* **2021**, n71, doi:10.1136/bmj.n71.

22. WHO ICD-10 Version:2019 2019.

23. Ouzzani, M.; Hammady, H.; Fedorowicz, Z.; Elmagarmid, A. Rayyan-a Web and Mobile App for Systematic Reviews. *Syst Rev* **2016**, *5*, 210, doi:10.1186/s13643-016-0384-4.

24. Moola, S.; Munn, Z.; Tufanaru, C.; Aromataris, E.; Sears, K.; Sfetcu, R.; Currie, M.; Qureshi, R.; Mattis, P.; Lisy, K.; et al. Chapter 7: Systematic Reviews of Etiology and Risk. In *Aromataris E, Munn Z (Editors). JBI Manual for Evidence Synthesis*; JBI, 2020.

25. Goldet, G.; Howick, J. Understanding GRADE: An Introduction. *J Evid Based Med* **2013**, *6*, 50–54, doi:10.1111/jebm.12018.

26. Albrecht, S.S.; Diez Roux, A.V.; Aiello, A.E.; Schulz, A.J.; Abraido-Lanza, A.F. Secular Trends in the Association between Nativity/Length of US Residence with Body Mass Index and Waist Circumference among Mexican-Americans, 1988–2008. *International Journal of Public Health* **2013**, *58*, 573–581, doi:10.1007/s00038-012-0414-5.

27. Altman, C.E.; Van Hook, J.; Gonzalez, J. Becoming Overweight without Gaining a Pound: Weight Evaluations and the Social Integration of Mexicans in the United States. *International Migration Review* **2017**, *51*, 3–36, doi:10.1111/imre.12220.

28. Angel, R.J.; Angel, J.L.; Hill, T.D. A Comparison of the Health of Older Hispanics in the United States and Mexico: Methodological Challenges. *Journal of Aging and Health* **2008**, *20*, 3–31, doi:10.1177/0898264307309924.

29. Antecol, H.; Bedard, K. Unhealthy Assimilation: Why Do Immigrants Converge to American Health Status Levels? *Demography* **2006**, *43*, 337–360, doi:10.1353/dem.2006.0011.

30. Anzman-Frasca, S.; Economos, C.D.; Tovar, A.; Boulos, R.; Sliwa, S.; Gute, D.M.; Pirie, A.; Must, A. Depressive Symptoms and Weight Status Among Women Recently Immigrating to the US. *Maternal and Child Health Journal* **2016**, *20*, 1578–1585, doi:10.1007/s10995-016-1957-5.

31. Boggess, B.; Bogue, H.O. The Health of U.S. Agricultural Worker Families: A Descriptive Study of over 790,000 Migratory and Seasonal Agricultural Workers and Dependents. *Journal of Health Care for the Poor and Underserved* **2016**, *27*, 778–792, doi:10.1353/hpu.2016.0089.

32. Caspi, C.E.; Tucker-Seeley, R.D.; Adamkiewicz, G.; Roberto, C.A.; Stoddard, A.M.; Sorensen, G.C. Food Hardship and Obesity in a Sample of Low-Income Immigrants. *Journal of Immigrant and Minority Health* **2017**, *19*, 130–137, doi:10.1007/s10903-016-0344-z.

33. Castañeda, S.F.; Rosenbaum, R.P.; Holscher, J.T.; Madanat, H.; Talavera, G.A. Cardiovascular Disease Risk Factors Among Latino Migrant and Seasonal Farmworkers. *Journal of Agromedicine* **2015**, *20*, 95–104, doi:10.1080/1059924X.2015.1010060.

34. Chakraborty, B.M.; Mueller, W.H.; Reeves, R.; Poston, W.S.C.; Holscher, D.M.; Quill, B.; Hanis, C.L.; Foreyt, J.P. Migration History, Health Behaviors, and Cardiovascular Disease Risk Factors in Overweight Mexican-American Women. *Ethn Dis* **2003**, *13*, 94–108.

35. Choi, J.Y. Prevalence of Overweight and Obesity Among US Immigrants: Results of the 2003 New Immigrant Survey. *Journal of Immigrant and Minority Health* **2012**, *14*, 1112–1118, doi:10.1007/s10903-011-9560-8.

36. Coffman, M.J.; Norton, C.K.; Beene, L. Diabetes Symptoms, Health Literacy, and Health Care Use in Adult Latinos with Diabetes Risk Factors. *J Cult Divers* **2012**, *19*, 4–9.

37. Davis, E.E.; Huffman, F.G. Differences in Coronary Heart Disease Risk Markers among Apparently Healthy Individuals of African Ancestry. *J Natl Med Assoc* **2007**, *99*, 658–664.

38. Elfassy, T.; Mossavar-Rahmani, Y.; Van Horn, L.; Gellman, M.; Sotres-Alvarez, D.; Schneiderman, N.; Daviglus, M.; Beasley, J.M.; Llabre, M.M.; Shaw, P.A.; et al. Associations of Sodium and Potassium with Obesity Measures Among Diverse US Hispanic/Latino Adults: Results from the Hispanic Community Health Study/Study of Latinos: Sodium, Potassium, and Obesity. *Obesity* **2018**, *26*, 442–450, doi:10.1002/oby.22089.

39. Gany, F.; Bari, S.; Gill, P.; Ramirez, J.; Ayash, C.; Loeb, R.; Aragones, A.; Leng, J. Step On It! Workplace Cardiovascular Risk Assessment of New York City Yellow Taxi Drivers. *Journal of Immigrant and Minority Health* **2016**, *18*, 118–134, doi:10.1007/s10903-015-0170-8.

40. Gill, R.M.; Khan, S.A.; Jackson, R.T.; Duane, M. Prevalence of the Metabolic Syndrome in Central and South American Immigrant Residents of the Washington, DC, Area. *Journal of Nutrition and Metabolism* **2017**, *2017*, 1–6, doi:10.1155/2017/9531964.

41. Giuntella, O.; Stella, L. The Acceleration of Immigrant Unhealthy Assimilation: IMMIGRANT OBESITY ASSIMILATION. *Health Economics* **2017**, *26*, 511–518, doi:10.1002/hec.3331.

42. Glick, J.E.; Yabiku, S.T. A Moving Paradox: A Binational View of Obesity and Residential Mobility. *Journal of Immigrant and Minority Health* **2015**, *17*, 489–497, doi:10.1007/s10903-014-0030-y.

43. Iten, A.E.; Jacobs, E.A.; Lahiff, M.; Fernández, A. Undocumented Immigration Status and Diabetes Care Among Mexican Immigrants In Two Immigration "Sanctuary" Areas. *Journal of Immigrant and Minority Health* **2014**, *16*, 229–238, doi:10.1007/s10903-012-9741-0.

44. Jackson, C.L.; Hu, F.B.; Redline, S.; Williams, D.R.; Mattei, J.; Kawachi, I. Racial/Ethnic Disparities in Short Sleep Duration by Occupation: The Contribution of Immigrant Status. *Social Science & Medicine* **2014**, *118*, 71–79, doi:10.1016/j.socscimed.2014.07.059.

45. Jaranilla, J.; DeFor, T.; Vazquez Benitez, G.; Kottke, T.E. Lipid Abnormalities in Foreign-Born and US-Born Patients in a Medical Group. *Journal of Clinical Lipidology* **2014**, *8*, 77–85, doi:10.1016/j.jacl.2013.10.007.

46. Jerome-D'Emilia, B.; Dunphy Suplee, P.; Gardner, M.R. Understanding Access to Care and Health Needs of Hispanic Women From an Urban Community. *Hispanic Health Care International* **2014**, *12*, 71–80, doi:10.1891/1540-4153.12.2.71.

47. Klabunde, R.A.; Lazar Neto, F.; Louzada, A.; de Moura, R.F.; Calixto, F.M.; Danaei, G.; Castro, M.C. Prevalence and Predictors of Overweight and Obesity in Brazilian Immigrants in Massachusetts. *BMC Public Health* **2020**, *20*, doi:10.1186/s12889-020-8144-8.

48. LeBrón, A.M.W.; Schulz, A.J.; Mentz, G.; Reyes, A.G.; Gamboa, C.; Israel, B.A.; Viruell-Fuentes, E.A.; House, J.S. Impact of Change over Time in Self-Reported Discrimination on Blood Pressure: Implications for Inequities in Cardiovascular Risk for a Multi-Racial Urban Community. *Ethnicity & Health* **2020**, *25*, 323–341, doi:10.1080/13557858.2018.1425378.

49. Li, K.; Wen, M.; Henry, K.A. Ethnic Density, Immigrant Enclaves, and Latino Health Risks: A Propensity Score Matching Approach. *Social Science & Medicine* **2017**, *189*, 44–52, doi:10.1016/j.socscimed.2017.07.019.

50. López, L.; Swett, K.; Rodriguez, F.; Kizer, J.R.; Penedo, F.; Gallo, L.; Allison, M.; Arguelles, W.; Gonzalez, F.; Kaplan, R.C.; et al. Association of Acculturation with Cardiac Structure and Function among Hispanics/Latinos: A Cross-Sectional Analysis of the Echocardiographic Study of Latinos. *BMJ Open* **2019**, *9*, e028729, doi:10.1136/bmjopen-2018-028729.

51. Martínez, A.D.; Juon, H.; Levine, D.M.; Lyford-Pike, V.; Peters, S. The Association between Nutrition Transition Score and Measures of Obesity: Results from a Cross-Sectional Study among Latina/o Immigrants in Baltimore. *Globalization and Health* **2014**, *10*, 57, doi:10.1186/1744-8603-10-57.

52. McClure, H.H.; Snodgrass, J.J.; Martinez, C.R.; Eddy, J.M.; Jiménez, R.A.; Isiordia, L.E. Discrimination, Psychosocial Stress, and Health among Latin American Immigrants in Oregon. *American Journal of Human Biology* **2010**, *22*, 421–423, doi:10.1002/ajhb.21002.

53. Narang, B.; Mirpuri, S.; Kim, S.Y.; Jutagir, D.R.; Gany, F. Lurking in Plain Sight: Hypertension Awareness and Treatment among New York City Taxi/For-hire Vehicle Drivers. *The Journal of Clinical Hypertension* **2020**, *22*, 962–969, doi:10.1111/jch.13869.

54. Rodriguez, F.; Hicks, L.S.; López, L. Association of Acculturation and Country of Origin with Self-Reported Hypertension and Diabetes in a Heterogeneous Hispanic Population. *BMC Public Health* **2012**, *12*, doi:10.1186/1471-2458-12-768.

55. Ryan, A.M.; Gee, G.C.; Laflamme, D.F. The Association between Self-Reported Discrimination, Physical Health and Blood Pressure: Findings from African Americans, Black Immigrants, and Latino Immigrants in New Hampshire. *Journal of Health Care for the Poor and Underserved* **2006**, *17*, 116–132, doi:10.1353/hpu.2006.0092.

56. Saint-Jean, G.; Crandall, L.A. Utilization of Preventive Care by Haitian Immigrants in Miami, Florida. *Journal of Immigrant and Minority Health* **2005**, *7*, 283–292, doi:10.1007/s10903-005-5125-z.

57. Shelley, D.; Tseng, T.-Y.; Andrews, H.; Ravenell, J.; Wu, D.; Ferrari, P.; Cohen, A.; Millery, M.; Kopal, H. Predictors of Blood Pressure Control Among Hypertensives in Community Health Centers. *American Journal of Hypertension* **2011**, *24*, 1318–1323, doi:10.1038/ajh.2011.154.

58. Shi, L.; Zhang, D.; van Meijgaard, J.; MacLeod, K.E.; Fielding, J.E. The Interaction Between an Individual's Acculturation and Community Factors on Physical Inactivity and Obesity: A Multilevel Analysis. *American Journal of Public Health* **2015**, *105*, 1460–1467, doi:10.2105/AJPH.2014.302541.

59. Singh-Franco, D.; Perez, A.; Wolowich, W.R. Improvement in Surrogate Endpoints by a Multidisciplinary Team in a Mobile Clinic Serving a Low-Income, Immigrant Minority Population in South Florida. *Journal of Health Care for the Poor and Underserved* **2013**, *24*, 67–77, doi:10.1353/hpu.2013.0028.

60. Tehranifar, P.; Protacio, A.; Schmitt, K.M.; Desperito, E.; Oskar, S.; Potter, A.J.; Engmann, N.J.; Terry, M.B. The Metabolic Syndrome and Mammographic Breast Density in a Racially Diverse and Predominantly Immigrant Sample of Women. *Cancer Causes & Control* **2015**, *26*, 1393–1403, doi:10.1007/s10552-015-0630-4.

61. Villarejo, D.; McCurdy, S.A.; Bade, B.; Samuels, S.; Lighthall, D.; Williams, D. The Health of California's Immigrant Hired Farmworkers. *American Journal of Industrial Medicine* **2010**, *53*, 387–397, doi:10.1002/ajim.20796.

62. Viruell-Fuentes, E.A.; Ponce, N.A.; Alegría, M. Neighborhood Context and Hypertension Outcomes Among Latinos in Chicago. *Journal of Immigrant and Minority Health* **2012**, *14*, 959–967, doi:10.1007/s10903-012-9608-4.

63. Wassink, J.; Perreira, K.M.; Harris, K.M. Beyond Race/Ethnicity: Skin Color and Cardiometabolic Health Among Blacks and Hispanics in the United States. *Journal of Immigrant and Minority Health* **2017**, *19*, 1018–1026, doi:10.1007/s10903-016-0495-y.

64. Weigel, M.M.; Armijos, R.X. Food Insecurity, Cardiometabolic Health, and Health Care in U.S.-Mexico Border Immigrant Adults: An Exploratory Study. *Journal of Immigrant and Minority Health* **2019**, *21*, 1085–1094, doi:10.1007/s10903-018-0817-3.

65. Weigel, M.M.; Armijos, R.X.; Hall, Y.P.; Ramirez, Y.; Orozco, R. The Household Food Insecurity and Health Outcomes of U.S.–Mexico Border Migrant and Seasonal Farmworkers. *Journal of Immigrant and Minority Health* **2007**, *9*, 157–169, doi:10.1007/s10903-006-9026-6.

66. Wolin, K.Y.; Colangelo, L.A.; Chiu, B.C.-H.; Gapstur, S.M. Obesity and Immigration Among Latina Women. *Journal of Immigrant and Minority Health* **2009**, *11*, 428–431, doi:10.1007/s10903-007-9115-1.

67. Dawson, A.Z.; Walker, R.J.; Gregory, C.; Egede, L.E. Relationship between Social Determinants of Health and Systolic Blood Pressure in United States Immigrants. *International Journal of Cardiology Hypertension* **2019**, *2*, 100011, doi:10.1016/j.ijchy.2019.100011.

68. Cohn, T.; Miller, A.; Fogg, L.; Braun, L.T.; Coke, L. Impact of Individual and Neighborhood Factors on Cardiovascular Risk in White Hispanic and Non-Hispanic Women and Men: ETHNICITY AND INDIVIDUAL AND NEIGHBORHOOD CARDIOVASCULAR RISK. *Research in Nursing & Health* **2017**, *40*, 120–131, doi:10.1002/nur.21778.

69. Del Brutto, O.H.; Dong, C.; Rundek, T.; Elkind, M.S.V.; Del Brutto, V.J.; Sacco, R.L. Cardiovascular Health Status Among Caribbean Hispanics Living in Northern Manhattan and Ecuadorian Natives/Mestizos in Rural Coastal Ecuador: A Comparative Study. *Journal of Community Health* **2013**, *38*, 634–641, doi:10.1007/s10900-013-9658-0.

70. López-Cevallos, D.F.; Escutia, G.; González-Peña, Y.; Garside, L.I. Cardiovascular Disease Risk Factors among Latino Farmworkers in Oregon. *Annals of Epidemiology* **2019**, *40*, 8-12.e1, doi:10.1016/j.annepidem.2019.10.002.

71. Pickering, R.P.; Grant, B.F.; Chou, S.P.; Compton, W.M. Are Overweight, Obesity, and Extreme Obesity Associated With Psychopathology?: Results From the National Epidemiologic Survey on Alcohol and Related Conditions. *The Journal of Clinical Psychiatry* **2007**, *68*, 998–1009, doi:10.4088/JCP.v68n0704.

72. Rodriguez, C.B.; Wei, Y.; Terry, M.B.; Wyka, K.; Athilat, S.; Albrecht, S.S.; Tehranifar, P. Associations of Nativity, Age at Migration, and Percent of Life in the U.S. with Midlife Body Mass Index and Waist Size in New York City Latinas. *International Journal of Environmental Research and Public Health* **2020**, *17*, 2436, doi:10.3390/ijerph17072436.

73. Slattery, M.L.; Sweeney, C.; Edwards, S.; Herrick, J.; Murtaugh, M.; Baumgartner, K.; Guiliano, A.; Byers, T. Physical Activity Patterns and Obesity in Hispanic and Non-Hispanic White Women: *Medicine & Science in Sports & Exercise* **2006**, *38*, 33–41, doi:10.1249/01.mss.0000183202.09681.2a.

74. Torres, J.M.; Deardorff, J.; Gunier, R.B.; Harley, K.G.; Alkon, A.; Kogut, K.; Eskenazi, B. Worry About Deportation and Cardiovascular Disease Risk Factors Among Adult Women: The Center for the Health Assessment of Mothers and Children of Salinas Study. *Annals of Behavioral Medicine* **2018**, *52*, 186–193, doi:10.1093/abm/kax007.

75. de Heer, H.D.; Salinas, J.; Lapeyrouse, L.M.; Heyman, J.; Morera, O.F.; Balcazar, H.G. Binational Utilization and Barriers to Care among Mexican American Border Residents with Diabetes. *Rev. Panam. Salud Publica* **2013**, *34*, 147–154.

76. Vega Briones, G. Problemas actuales de sobrepeso entre los migrantes mexicanos. *Migraciones internacionales* **2016**, *8*, 201–230.

77. Nelson, T.; Perez, A.; Alcaraz, J.; Talavera, G.; McCarthy, J.J. Family History of Diabetes, Acculturation, and the Metabolic Syndrome among Mexican Americans: Proyecto SALSA. *Metabolic Syndrome and Related Disorders* **2007**, *5*, 262–269, doi:10.1089/met.2006.0035.

78. Vaeth, P.A.C.; Willett, D.L. Level of Acculturation and Hypertension among Dallas County Hispanics: Findings from the Dallas Heart Study. *Annals of Epidemiology* **2005**, *15*, 373–380, doi:10.1016/j.annepidem.2004.11.003.

79. Chrisman, M.; Chow, W.-H.; Daniel, C.R.; Wu, X.; Zhao, H. Associations between Language Acculturation, Age of Immigration, and Obesity in the Mexican American Mano A Mano Cohort. *Obesity Research & Clinical Practice* **2017**, *11*, 544–557, doi:10.1016/j.orcp.2017.03.005.

80. López, L.; Grant, R.W.; Marceau, L.; Piccolo, R.; McKinlay, J.B.; Meigs, J.B. Association of Acculturation and Health Literacy with Prevalent Dysglycemia and Diabetes Control Among Latinos in the Boston Area Community Health (BACH) Survey. *Journal of Immigrant and Minority Health* **2016**, *18*, 1266–1273, doi:10.1007/s10903-016-0362-x.

81. Salinas, J.J.; Abdelbary, B.; Rentfro, A.; Fisher-Hoch, S.; McCormick, J. Cardiovascular Disease Risk Among the Mexican American Population in the Texas-Mexico Border Region, by Age and Length of Residence in United States. *Preventing Chronic Disease* **2014**, *11*, doi:10.5888/pcd11.130253.

82. Back, E.E.; Bachwani, A.S.; Strogatz, D.S.; Sherman, Z.M.V. Profile of Diabetes Mellitus among Immigrants from Guyana: Epidemiology and Implications for Community Action. *Ethn Dis* **2012**, *22*, 473–478.

83. US Census Bureau ACS 5-Year Estimates Public Use Microdata Sample Available online: https://data.census.gov/mdat/#/search?ds=ACSPUMS5Y2019&cv=ANC1P(360)&rv=ucgid&wt=PWGTP&g=0400000US05,06,08,09,10,11,12,13,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,44,45,46,47,48,49,50,51,53,54,55,56.

84. Rowland, M.L. Self-Reported Weight and Height. *The American Journal of Clinical Nutrition* **1990**, *52*, 1125–1133, doi:10.1093/ajcn/52.6.1125.

85. Stone, J.; Gurunathan, U.; Glass, K.; Munn, Z.; Tugwell, P.; Doi, S.A.R. Stratification by Quality Induced Selection Bias in a Meta-Analysis of Clinical Trials. *J Clin Epidemiol* **2019**, *107*, 51–59, doi:10.1016/j.jclinepi.2018.11.015.

7.2 ARTIGO 2: OVERWEIGHT AND OBESITY IN BRAZILIAN IMMIGRANTS IN MASSACHUSETTS, USA: A TIME SERIES ANALYSIS (2009-2020)

Artigo em submetido para a revista Obesity Facts.

Research Article

Overweight and Obesity in Brazilian Immigrants in Massachusetts, USA: A Time Series Analysis (2009-2020)

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Abstract

Introduction: Obesity is considered a growing public health problem by the Brazilian Ministry of Health and a global epidemic by the World Health Organization (WHO). In 2020, the Centers for Disease Control and Prevention (CDC) estimated the prevalence of adult obesity at 31.9% in the United States. The U.S. is one of the main destinations for Brazilian immigrants in search of better living conditions, and Massachusetts is one of the states with the highest presence of Brazilians. Changes in lifestyle and eating habits are often associated with increases in overweight and obesity in immigrants in the U.S., especially Hispanics, an official classification that does not, however, include Brazilians. In this context, the aim of this study is to describe the temporal trend of overweight and obesity in Brazilian immigrants assisted by the Cambridge Health Alliance (CHA) health care network in Massachusetts. Methods: This study is an ecological time series study of 128,206 records of Brazilians aged between 18 and 60 years based on hospital data from 2009 to 2020. Results: Mean age was 38.9 (sd=10.6) and 61% of the sample were women. The prevalence of overweight and obesity were 38.4% and 25.4%, respectively. Obesity exhibited an increasing trend (4.6/year), while overweight and eutrophy decreased (3.0/year and 7.2/year, respectively) during the study period. Conclusion: As little is known about the health of Brazilian immigrants in the U.S., this study contributes to the literature on the subject. The observed increasing trends agree with the worldwide increase in obesity and indicate the need for future research exploring individual factors associated to immigrant acculturation.

Keywords: Overweight. Obesity. Brazilian immigrants.

Introduction

Obesity has increased worldwide and is now considered a global epidemic [1–4]. According to the World Health Organization (WHO) [5], the worldwide prevalence of this condition has almost tripled between 1975 and 2016. In 2016, about 39% of adults over 18 years old were overweight and 13% obese. Developed countries remain the leaders in the rise of obesity, although similar upward trends are also observed in low- and middle-income countries [2,4].

According to Malik, Willett and Hu [2,4] some low- and middle-income countries have experienced an increase in the trend towards overweight and obesity in recent years, driven by global free trade, economic growth and urbanization, which favor the creation of obesogenic environments due to reduced physical activity and increased consumption of unhealthy foods such as refined grains, artificially sweetened beverages, processed products with low nutritional quality and high calorie content and animal products.

Obesity increases the risk of morbidity as well as mortality from chronic noncommunicable diseases, such as cardiovascular disease, diabetes mellitus, musculoskeletal diseases and some types of cancer. The worldwide mortality associated with overweight and obesity is higher than that associated with underweight [3,5].

As a country with low restrictions concerning food access or availability, the United States was one of the first countries to show signs that obesity became an epidemic, since it more than doubled between 1980 and 2010. In recent years, it has become stable at around 35%. However, its prevalence remains alarming and is now increasing among Hispanics and non-Hispanic blacks, indicating a disproportionate increase in different ethnic/racial groups [2,3].

Immigrants are the fastest growing segment in the U.S. [6,7]. It is, therefore, necessary to conduct studies that elucidate concerns related to their health, as well as responses aimed at public health planning and management, given the high costs that increasing overweight and obesity represent due to associated comorbidities [8].

Some studies demonstrate the high prevalence of overweight and obesity among Latinos, significantly associated to acculturation or integration in host societies, time of residence, and number of generations in the US, as immigrants with shorter periods of residence in the country tend to present lower Body Mass Index (BMI) when compared to Latinos who have lived in the country longer or who were born in the U.S. [6,7,9].

The emigration of Brazilians to the US is currently increasing, while the states of

Massachusetts and Florida are the main destinations for these immigrants [10]. As the Brazilian immigrant community is one of the largest in Massachusetts and overweight and obesity conditions have also increased in Brazil in recent decades [11], studies aimed at Brazilians are paramount. However, studies concerning Latino immigrants [6,7,9,12] do not consider or do not analyze Brazilian immigrants as a separate group. Brazil is a large country, with wide cultural variations throughout its territory and colonized by the Portuguese, unlike other Latin American countries. Thus, they should be evaluated separately from Latinos due to relevant cultural differences (e.g. diets) based on country of origin.

Our study contributes to create knowledge on the health of Brazilian immigrants in the US by describing the temporal trend of overweight and obesity among Brazilian patients cared for by the Cambridge Health Alliance (CHA) healthcare system in Massachusetts from 2009 to 2020. The main question guiding the study was: what is the trend of overweight and obesity over 12 years in Brazilian immigrants in Massachusetts? Our hypothesis was that overweight and obesity trends in Brazilian immigrants cared for by the CHA healthcare system have increased over the last few decades.

Material and Methods

This is an observational epidemiological, ecological time series study. The study population was Brazilian immigrant patients of the CHA network. This state has the second largest population of Brazilian immigrants in the U.S., totaling 92,957 immigrants according to the 2019 American Community Survey [13]. The study sample consisted of 128,206 records of Brazilian immigrant patients aged 18 to 60 cared for at one of the CHA network units from 2009 to 2020. This article is part of a larger study that seeks to analyze metabolic syndrome and sleep components in Brazilian immigrants in Massachusetts. Thus, a cutoff point of 60 years old was established, considering the changes that occur in ontogenesis and metabolism related to aging.

The analyzed data were obtained from the patient CHA network database. The CHA healthcare system [14] is a network of hospitals and health care centers formed in 1996 from the union of two Massachusetts hospitals, the Cambridge Hospital and the Somerville Hospital. In 2001, the acquisition of an additional hospital (formerly Whidden Memorial Hospital, now CHA Everett Hospital) and associated services in Malden and Revere expanded this network, currently present in five Massachusetts cities (Cambridge, Somerville, Everett, Malden and Revere). The

CHA healthcare system has offered bilingual and bicultural English/Portuguese outpatient, hospital, emergency and routine care for thousands of Brazilians for many years by.

Data were grouped considering a single consultation for each patient in each year, as the same patient's appointments in different years could not be identified. The dependent variable was patient BMI, obtained from hospital records and categorized as normal weight, overweight and obesity. The BMI classification followed the WHO [1]: eutrophy for BMI values between 18.50 and 24.99 kg/m², overweight for values between 25.00 and 29.99 kg/m² and obesity for values ≥ 30kg/m². The independent variable time (attendance year) was used to identify potential trends during the study period; sex and age were covariates.

Descriptive analyses were initially performed to calculate the mean and standard deviation for the continuous variables, and the absolute and relative frequencies for categorical variables. Next, normal weight, overweight and obesity rates were calculated, both gross and stratified by sex and age, for each year of the study period. For age stratification, the continuous variable was categorized into 18 to 32 years old, 33 to 47 years old and 48 to 60 years old. Rates were obtained by applying the following formulas:

Gross eutrophy rate:

$$\frac{\text{No. of Brazilian immigrants aged 18 to 60 years with BMI from 18.50 to 24.99 in (given year)}}{\text{Total Brazilian immigrants in (given year)}}$$

Stratified eutrophy rate:

$$\frac{\text{No. of (men or women) Brazilian immigrants of (defined age group) with BMI from 18.50 to 24.99 kg/m}^2\text{ in (given year)}}{\text{Total Brazilian immigrants (men or women) of (defined age group) in (given year)}}$$

Gross overweight rate:

$$\frac{\text{No. of (men or women) Brazilian immigrants from 18 to 60 years old with a BMI of 25.00 to 29.99kg/m}^2\text{ in (given year)}}{\text{Total Brazilian immigrants in (given year)}}$$

Stratified overweight rate:

$$\frac{\text{No. of (men or women) Brazilian immigrants of (defined age group) with BMI from 25.00 to 29.99 kg/m}^2\text{ in (given year)}}{\text{Total Brazilian immigrants (men or women) of (defined age group) in (given year)}}$$

Gross obesity rate:

$$\frac{\text{No. of Brazilian immigrants aged 18 to 60 years with BMI} \geq 30\text{kg/m}^2\text{ in (given year)}}{\text{Total Brazilian immigrants in (given year)}}$$

Stratified obesity rate:

$$\frac{\text{No. of (men or women) Brazilian immigrants of (defined age group) with BMI from} \geq 30\text{kg/m}^2\text{ in (given year)}}{\text{Total Brazilian immigrants (men or women) of (defined age group) in (given year)}}$$

For the trend analysis, rate dispersion diagrams were initially plotted, followed by polynomial regression models when potential diagram relationships were observed. The rates in the polynomial regression models were included as the dependent variable and time (year of visit) was the independent variable. Polynomial regression models frequently suffer from autocorrelation between the equation terms [15]. To reduce this effect, the variable "year" was transformed into "centralized year" by subtracting the midpoint of the study period (2014) from each year [15]. To reduce rate fluctuations and facilitate main trend interpretation, the rates were smoothed by applying the centralized moving average of order 3 [15].

Next, simple ($Y = \beta0 + \beta1X$), second degree ($Y = \beta0 + \beta1X + \beta2X^2$) and third degree ($Y = \beta0 + \beta1X + \beta2X^2 + \beta3X^3$) linear regression models were estimated. The choice of the best model was based on the best coefficient of determination (adjusted R^2), followed by the statistical significance of the model and by the residual analysis to confirm the homoscedasticity assumption of the model. The lowest-order model was chosen when two or more models were statistically similar. The trend was considered significant when $p \leq 0.05$. Data were organized and coded in Excel spreadsheets for further statistical analyses. All analyses were conducted using SPSS® Statistics, version 23.0.

All potential patient identifiers were removed prior to data access. The study followed the

requirements of the Ethics in Research with Human Beings (National Health Council, Resolution 466/2012) [16], approved by the National School of Public Health (ENSP) Research Ethics Committee (CEP ENSP) (CAAE 15012319.3.0000.5240), in Rio de Janeiro. It was granted exemption from requiring an ethics approval by the CHA Institutional Review Board (IRB).

Results

During the study period, a total of 128,206 records of Brazilian immigrants who sought care at CHA were analyzed. The population characteristics are presented in Table 1. Immigrants from 48 to 60 years old displayed the highest prevalence of both overweight (prevalence=43.8%, mean=44.2%, sd=1.0) and obesity (prevalence=30.8%, mean=30.8%, sd=1.4) (eutrophy: prevalence=25.1%, mean=24.6%, sd=1.6), followed by those 33 and 47 years old (eutrophy: prevalence=32.4%, mean=33.1%, SD=2.7; overweight: prevalence=40.3%, mean=40.0%, SD=1.0; obesity: prevalence=26.7%, mean=26.1%, sd=2.2) and 18 to 32 years old (eutrophy: prevalence=47.4%, mean=48.0%, sd=2.5; overweight: prevalence=31.2 %, mean=30.9%, sd=1.0; obesity: prevalence=19.1%, mean=18.7%, sd=1.9).

We observed an increase in overweight and obesity rates among Brazilians who sought care between 2009 and 2020, with small fluctuations over the years, totaling a 7.7% increase for the overweight and 25.5% for the obese, while a 20.1% decrease was observed for normal weight during this period (Table 1).

When considering the sex and age (Table 2) of immigrants who sought care between 2009 and 2020, we observed eutrophy decreases for both men and women from 18 and 32 years old (5.9% for men and 16.1% for women) and from 33 to 47 years old (27.8% for men and 16.1% for women), while increases were noted for men and women from 48 to 60 years old (0.1% for men and 18.6% for women).

Regarding overweight rates, we found a decrease among men for all ages (18-32 years: 11.1%; 33-47 years: 6.6%; 48-60 years: 6.0%), while 19.0% and 14.2% increases were observed in the age groups from 18 to 32 and 33 to 47 years old, respectively for women, with a 7.4% reduction noted from the 48 to 60 age group (Table 2). On the other hand, obesity rates increased for both sexes in all age groups (men: 18-32 years: 29.3%; 33-47 years: 34.3%; 48-60 years: 8.9 %; women: 18-32 years: 28.4%; and 33-47 years: 14.7%), with the exception of women aged 48 to 60 years, for whom there was a 4.7% decrease (Table 2). More detailed information is presented

in Supplemental File 1.

Regarding eutrophy, overweight, and obesity rates for every 1000 records of Brazilian immigrants who sought care during the study period (Table 3 and Fig. 1), we found a decreasing and constant trend for eutrophy rate, with a mean 7.2 decrease/year, and a statistically significant decreasing trend of overweight with a non-constant average annual increment of 3.0/year. As there is a negative acceleration of 0.6/year, the increment became negative at the end of the period. A statistically significant increasing trend in obesity was observed over the period, with a mean annual increase of 4.6/year, and a positive acceleration of 0.6/year.

When stratified for sex and age (Table 3 and Fig. 2), eutrophy rates decreased for men and women of all age groups. Rather than a growing trend, overweight rates, decreased for men from all age groups (18 to 32 years: mean annual reduction of 4.1/year; 33 to 47 years: mean annual reduction of 1.4/year, with negative acceleration of 1.4/year; 48 to 60 years old: mean annual reduction of 2.7/year), while there was an increasing trend for the 18 to 32 (mean annual increase of 4.2/year), and 33 to 47 (average annual increment of 3.8/year, with positive acceleration of 0.6/year) age groups for women, and decreased for the 48 to 60 age group (mean annual reduction of 3.4/year) (Table 3, Fig. 2).

An increasing trend in obesity rates for both men and women of all age groups was observed. For men, the increase in the 18 to 32 age group was constant, while for the other age groups it was not constant, with an average annual increment of 5.3/year for the 18 to 32 age group, an average annual increment of 8.0/year and positive acceleration of 1.7/year for the 33 to 47 age group, and a negative annual increment of 1.0/year, but with positive acceleration of 1.4/year for the 48 to 60 age group. For women, the obesity trend increased, was statistically significant and not constant for all age groups (18 to 32: average annual increase of 3.7/year, with positive acceleration of 0.5/year; 33 to 47: average annual increase of 1.3/year, with positive acceleration of 0.7/year; 48 to 60: average annual reduction of 1.2/year, but with positive acceleration of 0.8/year) (Table 3, Fig. 2).

Discussion/Conclusion

This study raises hypotheses on the increasing overweight and obesity trend over the years observed in a population of Brazilian immigrant patients of the CHA healthcare system. We chose the main overweight and obesity trends because they were the most significant in the time series.

Curve fluctuations may reflect the duration of the time series.

Between 2009 and 2020, there was an increase in the prevalence of overweight and obesity conditions among Brazilian patients. Increases in overweight and obesity also happened in national and state statistics in both the U.S. and Brazil. In Massachusetts, CDC data [17] show an increase in overweight and obesity for both the overall state population (1.1% overweight and 11.9% obesity increases, respectively) and Latinos (0.9% overweight and 16.0% obesity increases, respectively) from 2009 to 2020. During this period, the average overweight prevalence for the Massachusetts population and Latinos were 35.7% (sd=0.7) and 36.7% (sd=3.0) respectively, while the average obesity prevalence was 23.9% (sd=1.2) for the state population and 29.6% (sd=4.2) for Latinos.

According to Vigitel Brazil data[a], the prevalence of overweight and obesity has increased in the country from 2009 to 2020, 23.4% for overweight and 54.7% for obesity, respectively [11, 18–28]. In addition, the mean overweight and obesity prevalence during the same period were 52.3% (sd=3.4) (CI=46.6% - 57.5%) and 18.0% (sd=2.2) (CI =13.9% - 21.5%), respectively. The percentage increases in overweight (7.7%) and obesity (25.5%) rates for Brazilian patients during the study period are higher than those observed for the Latino population in Massachusetts and lower than those for the Brazilian population. However, the mean overweight (38.1%, sd=1.1) and obesity (24.8%, sd=2.0) prevalence approached the means for the U.S. population. The average overweight prevalence was higher than that for both the general Massachusetts population and for Latinos, while the average obesity rate is close to that noted for the Massachusetts population, although lower than that of Latinos. This finding is in line with other studies conducted on other Latino immigrant populations, where lower obesity rates in immigrants compared to Latinos in the U.S. are described [6,7,9,12].

There was higher obesity prevalence in the Brazilian immigrant patient population at CHA compared to Brazil in the time series, which may indicate a change from the Brazilian to the U.S. lifestyle norms, such as changes in eating habits and physical activity [6,29]. Martínez et al. [30] highlight the predisposition for weight gain that may occur among Latino immigrants due to the nutritional transition that many Latin American countries, including Brazil, have shown in recent

[a] The Vigitel Brazil is a telephone health survey that is in its 15th edition, conducted annually in 26 Brazilian states and in the Federal District, with the objective of monitoring the prevalence of Non-Transmissible Chronic Diseases and their risk factors among adults in Brazil [11].

decades. Thus, the shift from a country where increasing overweight and obesity rates are intense and constant, to another where the prevalence of obesity is even greater, may increase the probability of acculturation to obesogenic food environments and sedentary lifestyles.

Brazilians emigrate to the U.S. in search of better living conditions for themselves and their families [10], a reason historically recognized as an immigration driver. To improve their income, they accumulate jobs and often send remittances to family members who remain in Brazil [31]. This situation contributes to limiting sleep time, physical activity and the ability to maintain a healthy diet, due to the higher cost of unprocessed foods in the U.S.

The overweight and obesity prevalence among men and women patients suggests that overweight, followed by obesity, was more prevalent among men, while women showed a more prevalent normal weight, followed by overweight and obesity. This differs from findings reported in other studies [7,32] where obesity was the highest prevalence for women. However, our findings may indicate differences between men and women regarding concern and care for their own health [33,34].

The trends observed in this study indicate decreasing eutrophic and overweight rates and increasing obesity rates. This finding is similar to the global trend of increasing obesity [35] and may reflect changes in lifestyle in a society that works 24 hours a day [36].

There was a decreasing eutrophy trend for both men and women in all age groups, as well as an increasing overweight trend for women between 18 and 47 years old and a decreasing trend for men in all age groups. In addition, there was increasing obesity for both sexes in all age groups, though more intense for men aged 33 to 47 years. Those trends suggest that the transition from eutrophic to overweight and obese in both men and women is consistent with findings from other studies [12,29]. Furthermore, they indicate the need for studies with more complex designs that identify individual influencing factors as well as the implementation of interventions aimed at reducing overweight and obesity in this age group.

The lower prevalence as well as the slower increase in obesity among women may indicate that women are more concerned with their own health compared to men and seek help to maintain and/or lose weight. A similar result was found in another study [12] that investigated the association between acculturation and obesity in immigrants from Mexico. Chrisman et al. [12] noted a lower prevalence of obesity in women displaying higher levels of acculturation, which assumes that the greater the acculturation among women, the more they adopt the U.S. norm about

ideal weight and find ways to reduce their own weight.

National statistics also indicate overweight reduction among men (a 0.5% reduction) and increase among women (increase of 2.1%) for the Massachusetts population during the study period, with a mean prevalence of 42.8% (sd=1.3) for men and 28.7% (sd=1.0) for women. The data reveal an increase in obesity among both men (increase of 2.8%) and women (increase of 22.5%), although more intense among women, contrary to what we found in our study, where the average obesity prevalence was 25.5% for men (sd=1.2) and 22.3% for women (sd=1, 6) [17].

In Brazil, Vigitel data from 2009 to 2020 indicate increases in both overweight and obesity for men (overweight: 15.5%, obesity: 48.2%) and women (overweight: 32.9%, obesity: 61.4%). However, the increases were more intense and the annual prevalence higher for obesity among women. Among men, the mean overweight and obesity rates were 55.6% (sd=2.6) and 17.4% (sd=2.0), respectively, while for women the mean overweight prevalence was 49.4% (sd=4.2) and 18.5% for obesity (sd=2.5) [11,18–28].

The male and female obesity prevalence average for immigrants is higher than that of both Brazilian men and women. The decreasing trend in overweight observed for both women and men aged 48 to 60 may reflect better health care due to aging when other chronic diseases, such as diabetes and hypertension, are associated to weight gain and lead to changes in lifestyle [37]. Prasad, Sung and Aggarwal [37] emphasize that chronic diseases generally appear during middle age as a result of long-term exposure to unhealthy lifestyle behaviors, such as smoking, alcohol, unhealthy food consumption, sedentary life, and stress.

However, the curves observed for both men and women in this age group may be inconsistent considering the increasing trend of obesity, the decrease of eutrophy, and the increase in the prevalence of overweight and obesity with aging, as immigrants between 33 and 60 years showed the highest prevalence. This finding is consistent with the literature [38,39], which indicates that weight gain in adults tends to occur progressively during middle age. In the U.S., the average weight gain among adults ranges between 0.5 and 1 kg per year.

The overweight prevalence for the population of Massachusetts [17] increased in all age groups[b], ranging from 0.5% to 5.9%, with the exception of the age group from 35 to 44 years that

[b] CDC and Vigitel data divide the population into the age groups 18 to 24 years, 25 to 34 years, 35 to 44 years, 45 to 54 years, 55 to 64 years, and older than 65 years of age [11,17]. In our study we selected the age group 18 to 60 years and used the prevalences between the ages 18 to 64 years as a comparison.

had a 0.3% decrease. Obesity also increased in all age groups, with the exception of individuals from the 25 to 34 age group who displayed a 3.6% decrease. The greatest increase observed in the state was for the 35 to 44 age group (22.5%). In contrast, the Vigitel data [11,18–28] indicate both overweight and obesity increases in all age groups from 2009 to 2020 (overweight variation of 8.9% (55-54 years old) to 30.0% (25-34 years) and obesity variation from 26.6% (55-64 years) to 43.5% (18-24 years old)), except for overweight for the 18 to 24 age group, which had a 1.9% decrease. The obesity increases with aging we found corroborate both data from Massachusetts [17] and Vigitel Brazil [11,18–28], which also indicate a gradual increase with aging.

Our study had a few weaknesses. First, data from the studied population were grouped, which makes it impossible to control for individual factors that could justify the results, such as length of U.S. residence, immigrant generation and age at the time of migration, often associated with overweight and obesity increases in immigrants, as well as the effect of healthy immigrants in this population [6,40,7,9,12]. Second, the self-reported data from the national surveys employed for data comparisons may lead to weight underestimation among women and height overestimation among men [41], unlike our findings, which were based on medical records. Finally, the Berkson bias may have occurred, as the investigated individuals are a hospital patient population.

Our study identified decreasing eutrophy and overweight and increasing obesity trends in Brazilian immigrant patients in Massachusetts from 2009 to 2020. Obesity rates were higher than the prevalence observed in Brazil and close to that observed for the Massachusetts population, confirming our initial hypothesis. The same trend was observed in the sex stratified analyses. Male patients showed higher overweight and obesity prevalence than women. We also found a gradual increase in obesity with aging and a higher prevalence in the age group 48 to 60 years old.

Our findings describe the evolution of overweight and obesity over time in a large population of Brazilian immigrants. It raises new hypotheses to be tested in future studies focused on the individual level, where factors such as immigrant acculturation to host societies may be explored. Finally, it may contribute for the development of health promotion and prevention actions for the Brazilian immigrant population in the U.S.

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Statement of Ethics

The study followed the precepts of Ethics in Research with Human Beings (National Health Council, Resolution 466/2012), was approved by the ENSP Research Ethics Committee (CEP ENSP) (CAAE 15012319.3.0000.5240), in Rio de Janeiro and was granted an exemption from requiring ethics approval by the Institutional Review Board (IRB) of the CHA network in Cambridge, Massachusetts.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

T.M.P. developed the aim of the study, received data access, performed data analysis, and wrote the final version of the article; C.E.G.S. developed the aim of the study, articulated obtaining access to the database, and assisted in writing the final version of the article; E.T.C and K.M. articulated obtaining access to the database, and helped in writing the article; F.M.F, M.C.M and M.A.C. guided the statistical analysis and data interpretation; L.R.T. developed the aim of the study, guided the statistical analysis and data interpretation and helped in writing the final version of the article. All authors discussed the data and approved the final version of the article.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

References

1. WHO, organizador. Obesity: preventing and managing the global epidemic: report of a WHO consultation. Geneva: World Health Organization; 2000. 253 p. (WHO technical report series).

2. Malik VS, Willett WC, Hu FB. Global obesity: trends, risk factors and policy implications. Nat Rev Endocrinol. Jan. 2013;9(1):13–27.

3. Hruby A, Hu FB. The Epidemiology of Obesity: A Big Picture. PharmacoEconomics. Jul. 2015;33(7):673–89.

4. Malik VS, Willet WC, Hu FB. Nearly a decade on — trends, risk factors and policy implications in global obesity. Nat Rev Endocrinol. Nov. 2020;16(11):615–6.

5. WHO. Obesity and overweight [Internet]. 2021. Available in: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

6. Goel MS. Obesity Among US Immigrant Subgroups by Duration of Residence. JAMA. Dec. 2004;292(23):2860.

7. Barcenas CH, Wilkinson AV, Strom SS, Cao Y, Saunders KC, Mahabir S, et al. Birthplace, Years of Residence in the United States, and Obesity Among Mexican-American Adults*. Obesity. Apr. 2007;15(4):1043–52.

8. Akresh IR. Overweight and obesity among foreign-born and U.S.-born Hispanics. Biodemography and Social Biology. Sept. 2008;54(2):183–99.

9. Choi JY. Prevalence of Overweight and Obesity Among US Immigrants: Results of the 2003 New Immigrant Survey. Journal of Immigrant and Minority Health. Dec. 2012;14(6):1112–8.

10. Lima A, Siqueira CE. Brazilians in the U.S. and Massachusetts: A Demographic and Economic Profile. Boston, MA: Mauricio Gastón Institute, University of Massachusetts Boston; 2007.

11. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças não Transmissíveis. Vigitel Brasil 2020: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2020 [recurso eletrônico]. Brasília: Ministério da Saúde; 2021.

12. Chrisman M, Chow W-H, Daniel CR, Wu X, Zhao H. Associations between language acculturation, age of immigration, and obesity in the Mexican American Mano A Mano cohort. Obesity Research & Clinical Practice. Sept. 2017;11(5):544–57.

13. US Census Bureau. Selected population profile in the United States: Brazilians [Internet]. 2019. Available in: https://data.census.gov/cedsci/table?t=519%20-%20Brazilian%20%28360-364%29&g=0400000US25&tid=ACSSPP1Y2019.S0201&hidePreview=false.

14. CHA. About CHA [Internet]. 2021. Available in: https://www.challiance.org/about-cha.

15. Latorre MRDO, Cardoso MRA. Análise de séries temporais em epidemiologia: uma introdução sobre os aspectos metodológicos. Rev bras epidemiol. Nov. 2001;4(3):145–52.

16. Brasil. Conselho Nacional de Saúde [Internet]. Resolução no 466, de 12 de dezembro de 2012 2012. Disponível em: http://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf

17. CDC. BRFSS Prevalence & Trends Data [Internet]. 2021. Available in: https://www.cdc.gov/brfss/brfssprevalence/.

18. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Secretaria de Gestão Estratégica e Participativa. Vigitel Brasil 2010: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília: Ministério da Saúde; 2011. 152 p.

19. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Vigitel Brasil 2011: Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico. Brasília: Ministério da Saúde; 2012. 132 p.

20. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Secretaria de Gestão Estratégica e Participativa. Vigitel Brasil 2009: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília: Ministério da Saúde; 2013. 150 p.

21. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção de Saúde. Vigitel Brasil 2012: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília: Ministério da Saúde; 2013. 136 p.

22. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. Vigitel Brasil 2013: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília: Ministério da Saúde; 2014. 164 p.

23. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. Vigitel Brasil 2014: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília: Ministério da Saúde; 2015. 152 p.

24. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. Vigitel Brasil 2015: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2015 [recurso eletrônico]. Brasília: Ministério da Saúde; 2016. 160 p.

25. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. Vigitel Brasil 2016:

vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2016. Brasília: Ministério da Saúde; 2017. 160 p.

26. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. Vigitel Brasil 2017: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2017. Brasília: Ministério da Saúde; 2018. 130 p.

27. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças não Transmissíveis. Vigitel Brasil 2018: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2018. Brasília: Ministério da Saúde; 2019. 132 p.

28. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças Não Transmissíveis. Vigitel Brasil 2019: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2019 [recurso eletrônico]. Brasília: Ministério da Saúde; 2020. 137 p.

29. Davis EE, Huffman FG. Differences in coronary heart disease risk markers among apparently healthy individuals of African ancestry. J Natl Med Assoc. Jun. 2007;99(6):658–64.

30. Martínez AD, Juon H, Levine DM, Lyford-Pike V, Peters S. The association between nutrition transition score and measures of obesity: results from a cross-sectional study among Latina/o immigrants in Baltimore. Globalization and Health. 2014;10(1):57.

31. Siqueira CE, Jansen T. Working Conditions of Brazilian Immigrants in Massachusetts. Journal of Immigrant and Minority Health. 2012;14(3):481–8.

32. Castañeda SF, Rosenbaum RP, Holscher JT, Madanat H, Talavera GA. Cardiovascular Disease Risk Factors Among Latino Migrant and Seasonal Farmworkers. Journal of Agromedicine. Apr. 2015;20(2):95–104.

33. Vlassoff C. Gender differences in determinants and consequences of health and illness. J Health Popul Nutr. Mar. 2007;25(1):47–61.

34. Wang Y, Hunt K, Nazareth I, Freemantle N, Petersen I. Do men consult less than women? An analysis of routinely collected UK general practice data. BMJ Open. Aug. 2013;3(8):e003320.

35. WHO. World health statistics 2021: monitoring health for the SDGs, sustainable

development goals [Internet]. Geneva: World Health Organization; 2021. Available in: https://apps.who.int/iris/handle/10665/342703.

36. Fischer FM, Antunes ED, Silva-Junior JS, Rotenberg L. Working anywhere and anytime in the 24-h society: impact on the world of work. Ind Health. 2021;59(1):1–3.

37. Prasad S, Sung B, Aggarwal BB. Age-associated chronic diseases require age-old medicine: role of chronic inflammation. Prev Med. May 2012;54 Suppl:S29-37.

38. Hutfless S, Maruthur NM, Wilson RF, Gudzune KA, Brown R, Lau B, et al. Strategies to Prevent Weight Gain Among Adults [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2013. (AHRQ Comparative Effectiveness Reviews). Available in: http://www.ncbi.nlm.nih.gov/books/NBK133218/.

39. Zheng Y, Manson JE, Yuan C, Liang MH, Grodstein F, Stampfer MJ, et al. Associations of Weight Gain From Early to Middle Adulthood With Major Health Outcomes Later in Life. JAMA. Jul. 2017;318(3):255.

40. Antecol H, Bedard K. Unhealthy Assimilation: Why Do Immigrants Converge to American Health Status Levels? Demography. 2006;43(2):337–60.

41. Rowland ML. Self-reported weight and height. The American Journal of Clinical Nutrition. Dec.1990;52(6):1125–33.

ATTACHMENTS

Table 1. Population characterization and BMI distribution categories of Brazilian immigrants in Massachusetts, USA, 2009 to 2020.

Variable	General	Men	Women
	n (%) or mean ± SD	n (%) or mean ± SD	n (%) or mean ± SD
Gender (%)	128206 (100.0)	50063 (39.0)	78143 (61.0)
Age (mean ± sd)	38.9 ± 10.6	39.3 ± 10.6	38.6 ± 10.6
Age group (n (%))			
18 to 32 years old	38176 (29.8)	13637 (27.2)	24539 (31.4)
33 to 47 years old	59172 (46.2)	23741 (47.4)	35431 (45.3)
48 to 60 years old	30858 (24.1)	12685 (25.3)	18173 (23.3)
BMI (mean ± SD)	27.3 ± 5.2	28.2 ± 4.9	26.8 ± 5.3
BMI Categories (n (%))		**Average prevalence in the study period**		**Average prevalence in the study period**		**Average prevalence in the study period**
Eutrophy	44976 (35.1)	35.9 ± 2.6	12370 (24.7)	25.3 ± 2.0	32606 (41.7)	42.4 ± 2.5
Overweight	49286 (38.4)	38.1 ± 1.1	22808 (45.6)	45.8 ± 1.4	26478 (33.9)	33.4 ± 1.4
Obesity	32583 (25.4)	24.8 ± 2.0	14627 (29.2)	28.4 ± 2.9	17956 (23.0)	22.6 ± 1.7

Year	Total n (%)	BMI					
		Eutrophy n (%)	Rate	Overweight n (%)	Rate	Obesity n (%)	Rate
2009	4990 (3.9)	1986 (4.4)	398.0	1790 (3.6)	358.7	1133 (3.5)	227.1
2010	5537 (4.3)	2166 (4.8)	391.2	1995 (4.0)	360.3	1295 (4.0)	233.9
2011	5943 (4.6)	2287 (5.1)	384.8	2208 (4.5)	371.5	1387 (4.3)	233.4
2012	6566 (5.1)	2433 (5.4)	370.5	2530 (5.1)	385.3	1529 (4.7)	232.9
2013	11235 (8.8)	4204 (9.3)	374.2	4337 (8.8)	386.0	2584 (7.9)	230.0
2014	11330 (8.8)	4152 (9.2)	366.5	4398 (8.9)	388.2	2661 (8.2)	234.9
2015	11674 (9.1)	4171 (9.3)	357.3	4523 (9.2)	387.4	2862 (8.8)	245.2
2016	12457 (9.7)	4368 (9.7)	350.6	4855 (9.9)	389.7	3113 (9.6)	249.9
2017	13286 (10.4)	4539 (10.1)	341.6	5164 (10.5)	388.7	3450 (10.6)	259.7
2018	14138 (11.0)	4673 (10.4)	330.5	5463 (11.1)	386.4	3860 (11.8)	273.0
2019	15453 (12.1)	5039 (11.2)	326.1	5996 (12.2)	388.0	4263 (13.1)	275.9
2020	15597 (12.2)	4958 (11.0)	317.9	6027 (12.2)	386.4	4446 (13.6)	285.1
Total	128206 (100.0)	44976 (100.0)	350.8	49286 (100.0)	384.4	32583 (100.0)	254.1

Legend. BMI = Body Mass Index; dp = Standard Deviation. BMI obtained from medical records. Rate per 1000 records. Eutrophy: BMI 18.50 to 24.99 kg/m²; overweight: BMI 25.0 to 29.99 kg/m²; obesity: BMI ≥ 30kg/m². Low weight values not shown.

Table 2. Distribution and rates of BMI categories, according to sex and age, of Brazilian immigrants in Massachusetts, USA, 2009 to 2020

	Eutrophy								Overweight								Obesity							
	Men				Women				Men				Women				Men				Women			
Year	18-32	33-47	48-60	Total	18-32	33-47	48-60	Total	18-32	33-47	48-60	Total	18-32	33-47	48-60	Total	18-32	33-47	48-60	Total	18-32	33-47	48-60	Total
	n=5322	n=4731	n=2317	n=12370	n=12770	n=14415	n=5421	n=32606	n=5178	n=11437	n=6193	n=22808	n=6725	n=12419	n=7334	n=26478	n=2940	n=7534	n=4153	n=14627	n=4365	n=8255	n=5336	n=17956
	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate
2009	400.0	236.7	164.4	280.6	557.4	425.0	256.7	452.5	405.4	476.2	510.3	457.6	248.4	332.4	426.0	312.8	187.4	284.4	325.3	257.9	162.6	223.0	313.7	212.7
2010	394.4	240.6	141.2	272.5	568.4	424.2	249.6	451.4	399.4	474.6	484.2	451.7	244.0	324.1	449.9	313.9	194.8	282.6	374.6	270.9	155.3	236.6	298.9	215.1
2011	427.7	233.3	166.3	279.3	543.2	430.7	284.9	444.8	379.5	495.2	510.1	462.6	259.2	335.2	402.5	319.7	183.7	270.6	323.6	254.8	171.4	226.9	305.7	221.2
2012	409.0	216.8	142.1	258.4	535.7	425.1	310.8	439.9	395.8	514.4	518.5	479.7	270.4	340.7	392.7	327.1	189.9	267.9	337.6	259.6	157.1	227.0	293.0	216.4
2013	401.4	223.9	196.8	270.5	554.0	435.3	293.1	442.4	404.4	494.6	500.5	469.2	265.4	336.4	417.8	331.3	186.7	279.2	301.7	256.8	153.7	219.6	283.7	212.4
2014	378.0	218.2	216.2	261.1	540.8	437.4	300.1	436.1	400.0	506.0	484.1	471.8	271.4	329.0	418.9	332.9	208.2	275.0	298.8	262.6	160.7	222.5	276.0	216.5
2015	376.5	211.7	198.7	249.9	535.0	429.0	308.7	430.0	385.7	495.6	490.2	466.5	265.7	336.6	408.9	333.9	224.4	290.5	309.5	278.7	173.0	224.4	276.7	222.4
2016	383.2	199.8	191.7	242.8	522.8	430.1	302.6	423.4	378.3	498.3	494.9	467.8	268.8	344.4	399.0	337.1	222.3	300.7	310.5	284.0	181.3	217.4	293.8	226.9
2017	403.8	186.5	196.3	243.1	495.6	409.4	306.0	407.9	363.0	480.0	483.6	452.0	286.0	355.5	397.0	346.1	219.6	331.1	317.5	299.6	190.3	226.4	292.5	232.8
2018	385.0	179.8	183.6	234.1	503.0	377.7	301.5	395.0	361.9	469.4	469.3	441.5	282.5	368.5	392.9	349.6	234.0	349.7	345.8	318.6	190.1	244.3	300.1	242.5
2019	384.9	170.7	167.2	226.9	494.3	373.6	296.2	391.6	366.6	462.4	488.2	443.8	291.1	368.4	394.2	351.2	228.4	366.2	342.2	322.9	190.8	248.9	305.2	244.8
2020	376.4	170.8	164.5	224.4	467.5	356.7	304.6	377.9	360.5	444.8	479.5	431.6	295.6	379.5	394.3	357.4	242.4	381.9	354.2	336.8	208.8	255.7	298.9	251.8
Total	350.4	179.2	161.9	247.1	467.5	363.6	265.3	417.3	340.9	433.2	432.7	455.6	246.2	313.3	359.0	338.8	193.6	285.4	290.2	292.2	159.8	208.2	261.2	229.8

Legend. BMI obtained from medical records. Rate per 1000 records. Eutrophy: BMI 18.50 to 24.99 kg/m²; overweight: BMI 25.0 to 29.99 kg/m²; obesity: BMI ≥ 30kg/m².

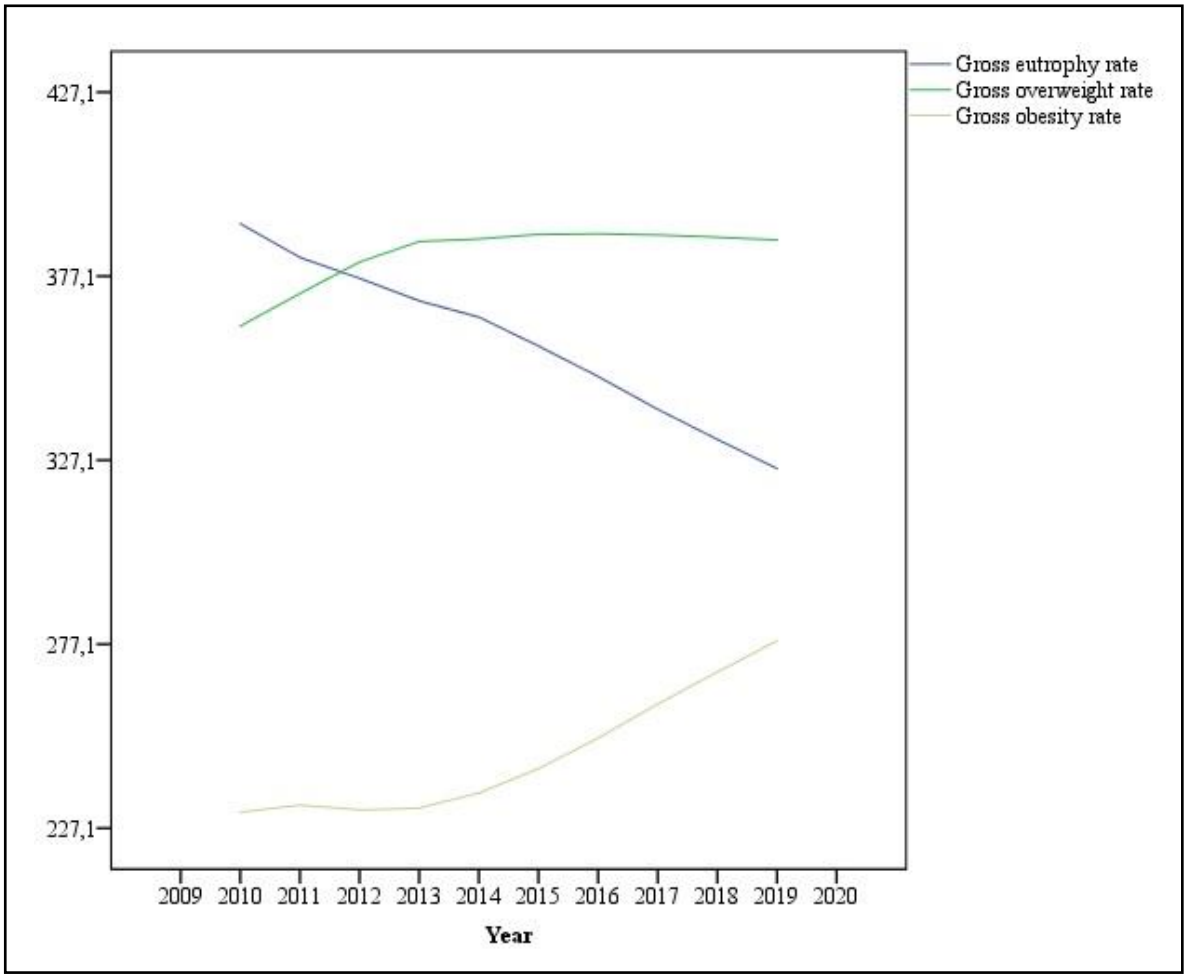


Fig. 1. Gross eutrophy, overweight and obesity rate trends for every 1000 care records of Brazilian immigrants in Massachusetts, USA, 2009 to 2020. Curves smoothed by centralized moving average (order 3).

Table 3. Trend analysis of gross and stratified normal weight, overweight and obesity rates by sex and age for every 1000 care records of Brazilian immigrants in Massachusetts, USA, 2009 to 2020

	Model	R^2 (%)	p-value	Trend (quadratic term)
Gross rate				
Eutrophy	$y = 362.727 - (7.243x)$	99.0	<0.001	Decreasing
Overweight	$y = 387.056 + (2.985x) - (0.588x^2)$	90.0	<0.001	Decreasing
Obesity	$y = 239.001 + (4.655x) + (0.581x^2)$	96.0	<0.001	Increasing
Stratified rate				
Men				
Eutrophy				
18-32 years old	$y = 394.623 - (2.541x)$	28.0	<0.05	Decreasing
33-47 years old	$y = 210.811 - (6.854x)$	94.0	<0.001	Decreasing
48-60 years old	$y = 192.071 + (3.422x) - (1.347x^2)$*	39.0	<0.05	Decreasing
Overweight				
18-32 years old	$y = 385.419 - (4.082x)$	69.0	0.001	Decreasing
33-47 years old	$y = 502.357 - (1.395x) – (1.426x^2)$*	86.0	<0.001	Decreasing
48-60 years old	$y = 494.130 - (2.700x)$	40.0	<0.05	Decreasing
Obesity				
18-32 years old	$y = 207.468 + (5.354x)$	84.0	<0.001	Increasing
33-47 years old	$y =282.276 + (8.034x) + (1.672x^2)$	97.0	<0.001	Increasing
48-60 years old	$y =311.385 - (1.035x) + (1.445x^2)$*	37.0	0.05	Increasing
Women				
Eutrophy				
18-32 years old	$y = 537.479 - (7.213x) - (0.608x^2)$	89.0	<0.001	Decreasing
33-47 years old	$y = 432.862 - (4.411x) - (1.464x^2)$	92.0	<0.001	Decreasing
48-60 years old	$y = 302.573 + (4.749x) - (0.991x^2)$	71.0	0.001	Decreasing
Overweight				
18-32 years old	$y= 268.628 + (4.158x)$	87.0	<0.001	Increasing
33-47 years old	$y = 336.992 + (3.814x) + (0.573x^2)$	89.0	<0.001	Increasing
48-60 years old	$y= 409.522 - (3.365x)$	43.0	<0.05	Decreasing
Obesity				
18-32 years old	$y = 166.214 + (3.728x) + (0.534x^2)$	84.0	<0.001	Increasing
33-47 years old	$y = 221.537 + (1.315x) + (0.728x^2)$	72.0	0.001	Increasing
48-60 years old	$y = 285.253 - (1.250x) + (0.839x^2)$*	58.0	<0.01	Increasing

Legend. BMI obtained from medical records. Rate per 1000 records. Eutrophy: BMI 18.50 to 24.99 kg/m²; overweight: BMI 25.0 to 29.99 kg/m²; obesity: BMI ≥ 30kg/m². * = only x^2 was significant.

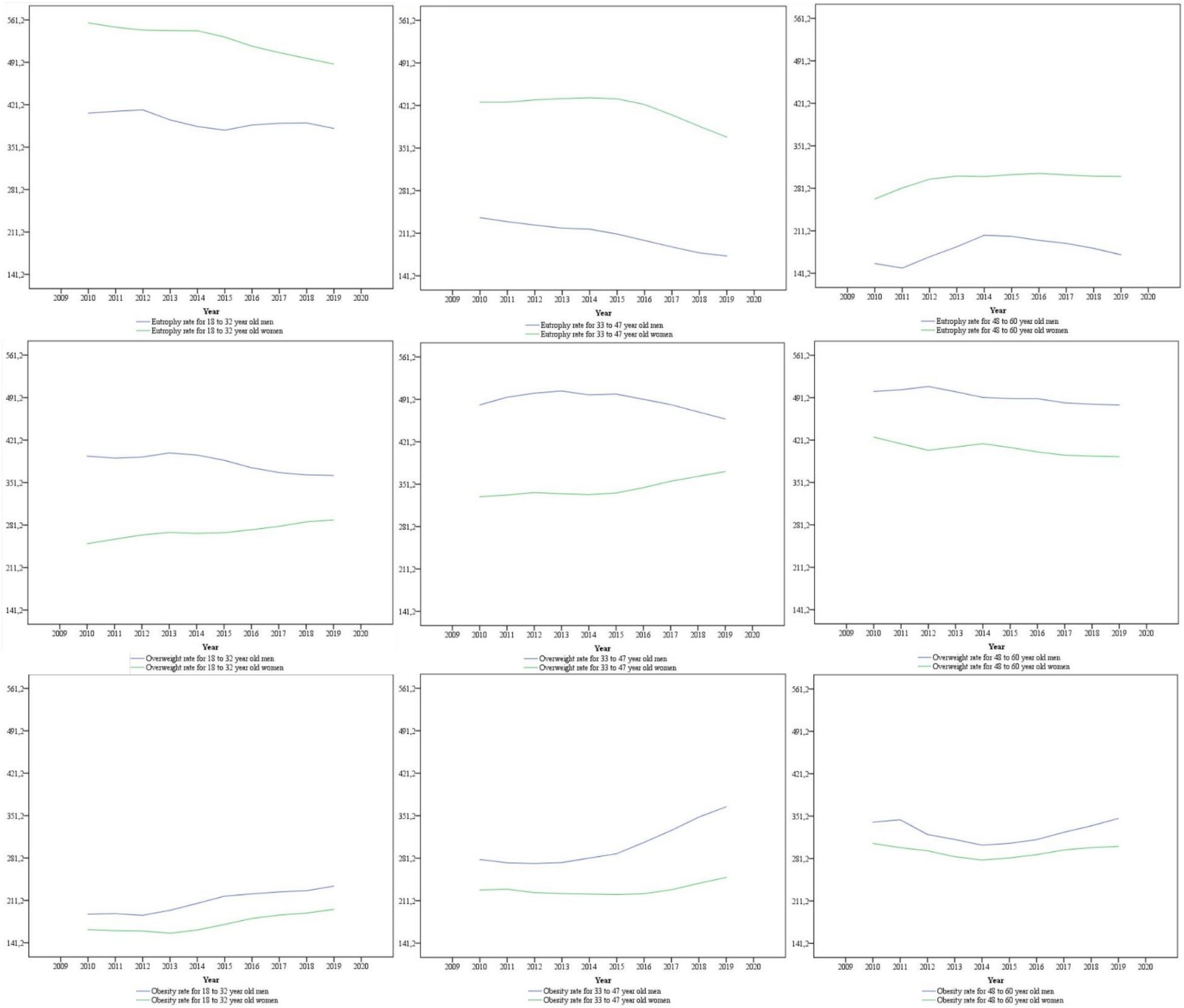


Fig. 2. Eutrophy, overweight and obesity rates trends, per sex and age, for every 1000 attendance records of Brazilian immigrants in Massachusetts, USA, 2009 to 2020. Curves smoothed by centralized moving average (order 3).

8 CONSIDERAÇÕES FINAIS

A revisão sistemática realizada contemplou 60 artigos conduzidos com imigrantes latinos nos EUA, que abordaram em seu conteúdo a síndrome metabólica e/ou a obesidade geral e abdominal, o diabetes mellitus tipo 2, a hipertensão, os triglicerídeos elevados e o colesterol HDL reduzido. Na meta-análise das prevalências da síndrome metabólica e de seus fatores de risco, 52 artigos foram incluídos. Os oito artigos restantes foram excluídos por não terem apresentado as informações necessárias para estimar as prevalências.

A maioria dos artigos identificados na revisão abordaram a obesidade geral, seguida pela hipertensão e o diabetes mellitus tipo 2. Observamos escassez de estudos que avaliaram a síndrome metabólica diagnosticada, a obesidade abdominal, o colesterol HDL reduzido o os triglicerídeos elevados nessa população. Levando em consideração o crescimento constante da obesidade e demais fatores associados à síndrome metabólica em populações minoritárias nos EUA, entre elas os latinos, bem como a relação da síndrome metabólica com o aumento do risco da mortalidade, a avaliação conjunta dos fatores de risco da síndrome se mostra essencial.

A meta-análise realizada identificou prevalências maiores para os desfechos de interesse do que as identificadas pelo CDC para a população latina em seis dos principais estados com maiores concentrações de imigrantes latinos nos EUA. Na análise adicional realizada para a hipertensão, o diabetes mellitus tipo 2 e a obesidade geral, identificamos maiores prevalências de hipertensão e diabetes tipo 2 para os latinos nascidos nos EUA, e maior de obesidade geral para os imigrantes latinos.

Quanto as populações latinas incluídas nos estudos, mais da metade dos artigos selecionados na revisão analisaram em sua amostra latinos de origem mexicana ou de países da América Central, com poucos estudos que incluíram latinos da América do Sul. Em relação aos brasileiros, identificamos apenas dois estudos que os analisaram separadamente em sua amostra. Esse resultado evidencia a necessidade de realização de mais estudos que visem investigar a síndrome metabólica e seus fatores de risco em imigrantes latinos provenientes da América do Sul, sendo o Brasil fortemente recomendado em decorrência principalmente das diferenças culturais, alimentares e linguísticas herdadas e construídas após a colonização do país por portugueses, comparadas com a colonização espanhola para grande parte dos países da América Latina.

O segundo artigo que compõe esse estudo buscou contribuir na construção do conhecimento acerca da saúde de imigrantes brasileiros, com enfoque no sobrepeso e na

obesidade, que estão entre os principais fatores de risco para a síndrome metabólica. Nesta análise, identificamos tendência crescente do sobrepeso e da obesidade e decrescente da eutrofia em imigrantes brasileiros atendidos na rede CHA em Massachusetts no período de 2009 a 2020. O mesmo foi observado nas análises estratificadas por sexo.

Em comparações realizadas com os resultados do estudo com dados do CDC para a população latina em Massachusetts e do Vigitel Brasil para o mesmo período encontramos maior prevalência de obesidade entre os imigrantes brasileiros comparados com a população brasileira, e proximidade dessa prevalência com a observada entre os latinos em Massachusetts.

Nas análises estratificadas por sexo e idade, notamos maiores prevalências do sobrepeso e da obesidade em homens em relação as mulheres, e um aumento gradual para os dois desfechos com o envelhecimento, sendo a faixa etária de 48 a 60 anos de idade a que apresentou maiores prevalências. Todavia, ao avaliarmos as tendências do sobrepeso e da obesidade nessa faixa etária, identificamos um decréscimo de ambas ao longo do tempo.

Os resultados encontrados em ambos os artigos confirmaram duas hipóteses desse estudo, demonstrando a escassez de artigos que incluem os imigrantes brasileiros nos EUA ou os analisam separadamente em sua amostra, e uma tendência crescente do sobrepeso e da obesidade nesses imigrantes. Contudo, a primeira hipótese de que a prevalência da síndrome metabólica e/ou seus fatores de risco é maior na população imigrante latina em relação à população latina nascida nos EUA só pôde ser testada para três desfechos na meta-análise, e se confirmou apenas para a obesidade geral.

Esse estudo traz conclusões importantes sobre o estado da arte da síndrome metabólica e seus fatores de risco em imigrantes latinos nos EUA, e contribui para a construção do conhecimento acerca da saúde de imigrantes brasileiros ao apresentar uma análise do sobrepeso e da obesidade em população extensa desses imigrantes durante 12 anos. A tendência crescente da obesidade em imigrantes brasileiros atendidos na rede hospitalar CHA encontrada nesse estudo sugere um risco elevado para a síndrome metabólica nessa população, tendo em vista que a obesidade é um dos principais fatores de risco para a síndrome. Estudos a nível individual com diferentes desenhos metodológicos precisam ser conduzidos nessa população, para que se possa identificar se o mesmo comportamento ocorre ao controlar fatores individuais que influenciariam o resultado.

Além de estudos do sobrepeso e obesidade, sugere-se aqueles que busquem avaliar a síndrome metabólica e seus fatores de risco nos imigrantes brasileiros, incluindo a avaliação do efeito de fatores relacionados ao processo migratório no desenvolvimento da síndrome

metabólica, como a aculturação a sociedades hospedeiras, o tempo de residência no país, a geração do imigrante, o status migratório, as condições de trabalho, hábitos de vida e questões referentes ao apoio social recebido pelo imigrante, seja de familiares, amigos ou vizinhança.

Este estudo pode contribuir, ainda, no planejamento e o direcionamento de ações buscando a prevenção e o controle do sobrepeso e da obesidade em imigrantes brasileiros, além de poder ser indutor de discussões de políticas públicas direcionadas aos imigrantes.

REFERÊNCIAS

AFABLE-MUNSUZ, A. et al. Immigrant Generation and Diabetes Risk Among Mexican Americans: The Sacramento Area Latino Study on Aging. **American Journal of Public Health**, v. 104, n. S2, p. S243–S250, abr. 2014.

AHMED, A. T. et al. Generational status and duration of residence predict diabetes prevalence among Latinos: the California Men's Health Study. **BMC Public Health**, v. 9, n. 1, dez. 2009.

AL-NAIMI, S. et al. Postprandial metabolic profiles following meals and snacks eaten during simulated night and day shift work. **Chronobiology International**, v. 21, n. 6, p. 937–947, 2004.

ASSIS, G. DE O. Mulheres migrantes no passado e no presente: gênero, redes sociais e migração internacional. **Revista Estudos Feministas**, v. 15, n. 3, p. 745–772, dez. 2007.

ATKINSON, G. et al. Exercise, energy balance and the shift worker. **Sports Medicine** (Auckland, N.Z.), v. 38, n. 8, p. 671–685, 2008.

BAENINGER, R. Notas acerca das migrações internacionais no século 21. In: Baeninger, R. **Migração Internacional**. Campinas: Núcleo de Estudos de População - Nepo/Unicamp: [s.n.].

BAFFI, C. W. et al. Metabolic Syndrome and the Lung. **Chest**, v. 149, n. 6, p. 1525–1534, 2016.

BALDWIN, C. M. et al. Overview of Sleep Disorders Among Latinos in the United States. **Hispanic Health Care International**, v. 8, n. 4, p. 180–187, 1 dez. 2010.

BARCENAS, C. H. et al. Birthplace, Years of Residence in the United States, and Obesity Among Mexican-American Adults*. **Obesity**, v. 15, n. 4, p. 1043–1052, abr. 2007.

BELTRÁN-SÁNCHEZ, H. et al. Prevalence and trends of metabolic syndrome in the adult U.S. population, 1999-2010. **Journal of the American College of Cardiology**, v. 62, n. 8, p. 697–703, 20 ago. 2013.

BELTRÁN-SÁNCHEZ, H. et al. SES Gradients Among Mexicans in the United States and in Mexico: A New Twist to the Hispanic Paradox? **Demography**, v. 53, n. 5, p. 1555–1581, out. 2016.

BELTRÃO, F.; PENA, P. Associação entre Síndrome Metabólica e Saúde no Trabalho. **Rev Bras Med Trab**, v. 11, n. 1, p. 3–18, 2013.

BLOOM, S. R. et al. The obesity epidemic: pharmacological challenges. **Molecular Interventions**, v. 8, n. 2, p. 82–98, abr. 2008.

BODEN, G. et al. Evidence for a circadian rhythm of insulin secretion. **The American Journal of Physiology**, v. 271, n. 2 Pt 1, p. E246-252, ago. 1996.

BRASIL. Ministério da Saúde. Secretaria de Vigilância em Saúde. Secretaria de Gestão Estratégica e Participativa. **Vigitel Brasil 2010:** vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília: Ministério da Saúde, 2011. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/vigitel_2010.pdf. Acesso em: 14 out. 2021.

BRASIL. Ministério da Saúde. **Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico:** Vigitel 2015 [Internet]. Brasília: Ministério da Saúde, 2017. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/vigitel_brasil_2015.pdf. Acesso em: 14 out. 2021.

BRASIL. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças não Transmissíveis. **Vigitel Brasil 2020:** vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico [recurso eletrônico]. Brasília: Ministério da Saúde, 2021. Disponível em: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/publicacoes-svs/vigitel/relatorio-vigitel-2020-original.pdf/view. Acesso em: 14 out. 2021.

BRASIL. Ministério da Saúde. Secretaria de Vigilância em Saúde. **Vigitel Brasil:** vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Publicações 2010-2020, 2022. Disponível em: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/publicacoes-svs/vigitel. Acesso em: 14 out. 2021.

CANUTO, R.; GARCEZ, A. S.; OLINTO, M. T. A. Metabolic syndrome and shift work: a systematic review. **Sleep Medicine Reviews**, v. 17, n. 6, p. 425–431, dez. 2013.

CDC. **BRFSS Prevalence & Trends Data**. Disponível em: https://www.cdc.gov/brfss/brfssprevalence/. Acesso em: 10 out. 2021.

CHAKRABORTY, B. M. et al. Migration history, health behaviors, and cardiovascular disease risk factors in overweight Mexican-American women. **Ethnicity & Disease**, v. 13, n. 1, p. 94–108, 2003.

CHOI, J. Y. Prevalence of Overweight and Obesity Among US Immigrants: Results of the 2003 New Immigrant Survey. **Journal of Immigrant and Minority Health**, v. 14, n. 6, p. 1112–1118, dez. 2012.

COMMODORE-MENSAH, Y. et al. Hypertension, overweight/obesity, and diabetes among immigrants in the United States: an analysis of the 2010–2016 National Health Interview Survey. **BMC Public Health**, v. 18, n. 1, dez. 2018.

COOPER, C. B. et al. Sleep deprivation and obesity in adults: a brief narrative review. **BMJ Open Sport & Exercise Medicine**, v. 4, n. 1, p. e000392, out. 2018.

DAMASO, A. **Etiologia da obesidade**. Rio de Janeiro: Medsi, 2003.

DATE, Y. et al. Ghrelin, a novel growth hormone-releasing acylated peptide, is synthesized in a distinct endocrine cell type in the gastrointestinal tracts of rats and humans. **Endocrinology**, v. 141, n. 11, p. 4255–4261, nov. 2000.

DELAVARI, M. et al. Acculturation and obesity among migrant populations in high income countries--a systematic review. **BMC public health**, v. 13, p. 458, 10 maio 2013.

DUARTE, N. A.; ESCRIVÃO JUNIOR, Á.; SIQUEIRA, S. O acesso aos serviços de saúde por emigrantes brasileiros nos Estados Unidos. **Saúde e Sociedade**, v. 22, n. 2, p. 365–376, jun. 2013.

FISCHER, F. M. As demandas da sociedade atual: aspectos históricos do desenvolvimento do trabalho em turnos no mundo – conceitos, escalas de trabalho, legislação brasileira. In: Fischer, F. M., Moreno, C. R. C., Rotenberg, L. **Trabalho em turnos e noturno na sociedade 24 horas**. São Paulo: Atheneu, 2004. p. 3–17.

FISCHER, F.; MORENO, C.; ROTENBERG, L. Trabalho em turnos e noturno: impactos sobre o bem-estar e saúde dos trabalhadores. Possíveis intervenções. In: René Mendes. (Org.). **Patologia do trabalho**. 3ª ed. São Paulo: Atheneu, 2013. p. 753–782.

FOOTRACER, K. G. Immigrant health care in the United States: what ails our system? **JAAPA:** official journal of the American Academy of Physician Assistants, v. 22, n. 4, p. 33–36, 60, abr. 2009.

FUSCO, W. A formação de comunidades-filhas no fluxo de brasileiros para os Estados Unidos. **São Paulo em Perspectiva**, v. 19, n. 3, p. 55–63, set. 2005.

GARAULET, M.; ORDOVÁS, J. M.; MADRID, J. A. The chronobiology, etiology and pathophysiology of obesity. **International Journal of Obesity (2005)**, v. 34, n. 12, p. 1667–1683, dez. 2010.

GILL, R. M. et al. Prevalence of the Metabolic Syndrome in Central and South American Immigrant Residents of the Washington, DC, Area. **Journal of Nutrition and Metabolism**, v. 2017, p. 1–6, 2017.

GOEL, M. S. Obesity Among US Immigrant Subgroups by Duration of Residence. **JAMA**, v. 292, n. 23, p. 2860, 15 dez. 2004.

GRUNDY, S. M. et al. Diagnosis and Management of the Metabolic Syndrome: An American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. **Circulation**, v. 112, n. 17, p. 2735–2752, 25 out. 2005.

HALE, L.; DO, D. P.; RIVERO-FUENTES, E. What Do We Know About Mexican Immigration and Sleep? A Population-Based Study and Future Research Directions. **Hispanic Health Care International**, v. 8, n. 4, p. 199–208, 1 dez. 2010.

HRUBY, A.; HU, F. B. The Epidemiology of Obesity: A Big Picture. **PharmacoEconomics**, v. 33, n. 7, p. 673–689, jul. 2015.

HUBERT, H.; SNIDER, J.; WINKLEBY, M. Health status, health behaviors, and acculturation factors associated with overweight and obesity in Latinos from a community and agricultural labor camp survey. **Preventive Medicine**, v. 40, n. 6, p. 642–651, jun. 2005.

IFTIKHAR, I. H. et al. Sleep Duration and Metabolic Syndrome. An Updated Dose–Risk Metaanalysis. **Annals of the American Thoracic Society**, v. 12, n. 9, p. 1364–1372, set. 2015.

INTERNATIONAL LABOUR OFFICE. **Women and men in the informal economy:** a statistical picture. third edition ed. Geneva: International Labour Office, 2018. Disponível em: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_626831.pdf. Acesso em: 2 fev. 2019.

JACKSON, C. L. et al. Racial/ethnic disparities in short sleep duration by occupation: The contribution of immigrant status. **Social Science & Medicine**, v. 118, p. 71–79, out. 2014.
JENKINS, D. J. A. Carbohydrate tolerance and food frequency. **British Journal of Nutrition**, v. 77, n. S1, p. S71, abr. 1997.

KETCHUM, E. S.; MORTON, J. M. Disappointing weight loss among shift workers after laparoscopic gastric bypass surgery. **Obesity Surgery**, v. 17, n. 5, p. 581–584, maio 2007.

KHOO, M. C. K.; OLIVEIRA, F. M. G. S.; CHENG, L. Understanding the metabolic syndrome: a modeling perspective. **IEEE reviews in biomedical engineering**, v. 6, p. 143–155, 2013.

KLOK, M. D.; JAKOBSDOTTIR, S.; DRENT, M. L. The role of leptin and ghrelin in the regulation of food intake and body weight in humans: a review. **Obesity Reviews:** An Official Journal of the International Association for the Study of Obesity, v. 8, n. 1, p. 21–34, jan. 2007.

KOJIMA, M. et al. Ghrelin is a growth-hormone-releasing acylated peptide from stomach. **Nature**, v. 402, n. 6762, p. 656–660, 9 dez. 1999.

LANGENBERG, C. et al. Ghrelin, adiponectin, and leptin do not predict long-term changes in weight and body mass index in older adults: longitudinal analysis of the Rancho Bernardo cohort. **American Journal of Epidemiology**, v. 162, n. 12, p. 1189–1197, 15 dez. 2005.

LAZAR-NETO, F. et al. Depression and Its Correlates Among Brazilian Immigrants in Massachusetts, USA. **Journal of Immigrant and Minority Health**, v. 20, n. 4, p. 832–840, ago. 2018.

LEÓN, A. M. Teorías y conceptos asociados al estudio de las migraciones internacionales. **Trabajo Social**, v. 7, p. 59–76, 2005.

LICINIO, J. et al. Human leptin levels are pulsatile and inversely related to pituitary-adrenal function. **Nature Medicine**, v. 3, n. 5, p. 575–579, maio 1997.

LICINIO, J. et al. Synchronicity of frequently sampled, 24-h concentrations of circulating leptin, luteinizing hormone, and estradiol in healthy women. **Proceedings of the National Academy of Sciences of the United States of America**, v. 95, n. 5, p. 2541–2546, 3 mar. 1998.

LIMA, A.; SIQUEIRA, C. E. **Brazilians in the U.S. and Massachusetts:** A Demographic and Economic Profile. Boston, MA: Mauricio Gastón Institute, University of Massachusetts Boston, 2007.

LINDHOLM, H. et al. Attenuation of vagal recovery during sleep and reduction of cortisol/melatonin ratio in late afternoon associate with prolonged daytime sleepiness among media workers with irregular shift work. **American Journal of Industrial Medicine**, v. 55, n. 7, p. 643–649, jul. 2012.

MALIK, V. S.; WILLETT, W. C.; HU, F. B. Global obesity: trends, risk factors and policy implications. **Nature Reviews Endocrinology**, v. 9, n. 1, p. 13–27, jan. 2013.

MARCARINI, M.; MENDES, K. Síndrome metabólica e a sua relação com o estado nutricional em adolescentes – variabilidade de critérios diagnósticos. **Scientia Medica (Porto Alegre)**, v. 23, n. 2, p. 108–118, 2013.

MARCELLI, E. et al. **(In)Visible (Im)Migrants:** The Health and Socioeconomic Integration of Brazilians in Metropolitan Boston. San Diego: Center for Behavioral and Community Health Studies, San Diego State University, 2009.

MARQUEZE, E. C.; ULHÔA, M. A.; CASTRO MORENO, C. R. Leisure-time physical activity does not fully explain the higher body mass index in irregular-shift workers. **International Archives of Occupational and Environmental Health**, v. 87, n. 3, p. 229–239, abr. 2014.

MAURY, E.; HONG, H. K.; BASS, J. Circadian disruption in the pathogenesis of metabolic syndrome. **Diabetes & Metabolism**, v. 40, n. 5, p. 338–346, nov. 2014.

MENDES, R. Conceito de adoecimento relacionado ao trabalho e sua taxonomia. In: Mendes, R. **Patologia do Trabalho**. 3. ed. São Paulo: Atheneu, 2013. p. cap. 4.

MUNDINGER, T. O.; CUMMINGS, D. E.; TABORSKY, G. J. Direct stimulation of ghrelin secretion by sympathetic nerves. **Endocrinology**, v. 147, n. 6, p. 2893–2901, jun. 2006.

NCEP. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. **Circulation**, v. 106, n. 25, p. 3143–3421, 17 dez. 2002.

NELSON, T. et al. Family History of Diabetes, Acculturation, and the Metabolic Syndrome among Mexican Americans: Proyecto SALSA. **Metabolic Syndrome and Related Disorders**, v. 5, n. 3, p. 262–269, set. 2007.

OLIVEIRA, W. A. A imigração dos venezuelanos para o Brasil e a atuação da Polícia Federal na fronteira: uma análise sobre as solicitações de refúgio e residência temporária. **Revista Brasileira de Ciências Policiais**, v. 11, n. 3, p. 231–263, 30 set. 2020.

OZA-FRANK, R.; CUNNINGHAM, S. A. The weight of US residence among immigrants: a systematic review. **Obesity Reviews:** An Official Journal of the International Association for the Study of Obesity, v. 11, n. 4, p. 271–280, abr. 2010.

PATARRA, N. L. Migrações internacionais de e para o Brasil contemporâneo: volumes, fluxos, significados e políticas. **São Paulo em Perspectiva**, v. 19, n. 3, p. 23–33, set. 2005.

PATARRA, N. L. Migrações internacionais: teorias, políticas e movimentos sociais. **Estudos Avançados**, v. 20, n. 57, p. 7–24, ago. 2006.

RAJARATNAM, S. M.; ARENDT, J. Health in a 24-h society. **Lancet (London, England)**, v. 358, n. 9286, p. 999–1005, 22 set. 2001.

REAVEN, G. M. Role of Insulin Resistance in Human Disease. **Diabetes**, v. 37, n. 12, p. 1595–1607, 1 dez. 1988.

ROHNER-JEANRENAUD, F.; JEANRENAUD, B. Obesity, Leptin, and the Brain. **New England Journal of Medicine**, v. 334, n. 5, p. 324–325, fev. 1996.

SAPIN, R. et al. Elecsys insulin assay: free insulin determination and the absence of cross-reactivity with insulin lispro. **Clinical Chemistry**, v. 47, n. 3, p. 602–605, mar. 2001.

SCHEER, F. A. J. L. et al. Adverse metabolic and cardiovascular consequences of circadian misalignment. **Proceedings of the National Academy of Sciences of the United States of America**, v. 106, n. 11, p. 4453–4458, 17 mar. 2009.

SCHWARTZ, M. W.; MORTON, G. J. Obesity: keeping hunger at bay. **Nature**, v. 418, n. 6898, p. 595–597, 8 ago. 2002.

SHEA, S. A. et al. Independent circadian and sleep/wake regulation of adipokines and glucose in humans. **The Journal of Clinical Endocrinology and Metabolism**, v. 90, n. 5, p. 2537–2544, maio 2005.

SHI, T. H.; WANG, B.; NATARAJAN, S. The Influence of Metabolic Syndrome in Predicting Mortality Risk Among US Adults: Importance of Metabolic Syndrome Even in Adults With Normal Weight. **Preventing Chronic Disease**, v. 17, p. 200020, 21 maio 2020.

SIQUEIRA, C. E. Immigrant Workers as the Future of a Progressive Safety and Health Movement in the United States. **NEW SOLUTIONS:** A Journal of Environmental and Occupational Health Policy, v. 21, n. 1, p. 5–8, maio 2011.

SIQUEIRA, C. E. Does Informal Employment Exist in the United States and Other Developed Countries? **NEW SOLUTIONS:** A Journal of Environmental and Occupational Health Policy, v. 26, n. 2, p. 337–339, ago. 2016.

SIQUEIRA, C. E. Migração e Saúde dos Brasileiros Imigrantes em Massachusetts. In: Siqueira, S. (Org). **Ligações Migratórias Contemporâneas:** Brasil, Estados Unidos e Portugal. 1. ed. Governador Valadares, MG: Univale, 2018a. p. 60–79.

SIQUEIRA, C. E.; JANSEN, T. Working Conditions of Brazilian Immigrants in Massachusetts. **Journal of Immigrant and Minority Health**, v. 14, n. 3, p. 481–488, 2012.

SIQUEIRA, C. E.; ROCHE, A. G. Occupational Health Profile of Brazilian Immigrant Housecleaners in Massachusetts. **NEW SOLUTIONS:** A Journal of Environmental and Occupational Health Policy, v. 23, n. 3, p. 505–520, 2013.

SIQUEIRA, C. E.; SIQUEIRA, S. O perfil sociodemográfico e de saúde dos retornados mineiros para a região de Governador Valadares. **Revista USP**, n. 114, p. 119, 16 set. 2017.

SIQUEIRA, S. **Ligações migratórias contemporâneas:** Brasil, Estados Unidos e Portugal. Governador Valadares, MG: Núcleo de Estudos Multidisciplinar Sobre o Desenvolvimento Regional, Universidade Vale do Rio Doce: UNIVALE, 2018b.

SOOKOIAN, S. et al. Effects of rotating shift work on biomarkers of metabolic syndrome and inflammation. **Journal of Internal Medicine**, v. 261, n. 3, p. 285–292, mar. 2007.
STABELINI NETO, A. et al. Síndrome metabólica em adolescentes de diferentes estados nutricionais. **Arquivos Brasileiros de Endocrinologia & Metabologia**, v. 56, n. 2, p. 104–109, mar. 2012.

TEHRANIFAR, P. et al. The metabolic syndrome and mammographic breast density in a racially diverse and predominantly immigrant sample of women. **Cancer Causes & Control**, v. 26, n. 10, p. 1393–1403, out. 2015.

TSCHÖP, M. et al. Post-prandial decrease of circulating human ghrelin levels. **Journal of Endocrinological Investigation**, v. 24, n. 6, p. RC19-21, jun. 2001.

UEBEL, R. R. G.; RÜCKERT, A. A. Aspectos gerais da dinâmica imigratória no Brasil no século XXI. **Confins**, n. 31, 8 jun. 2017.

US CENSUS BUREAU. **Hispanic or Latino Origin**. Disponível em: https://www.census.gov/acs/www/about/why-we-ask-each-question/ethnicity/. Acesso em: 22 nov. 2021.

US CENSUS BUREAU. **ACS 5-Year Estimates Public Use Microdata Sample**. 2019a. Disponível em: https://data.census.gov/mdat/#/search?ds=ACSPUMS5Y2019&cv=ANC1P(360)&rv=ucgid&wt=PWGTP&g=0400000US05,06,08,09,10,11,12,13,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,44,45,46,47,48,49,50,51,53,54,55,56. Acesso em: 04 out. 2021.

US CENSUS BUREAU. **Selected population profile in the United States:** Brazilians. 2019b. Disponível em: https://data.census.gov/cedsci/table?t=519%20-%20Brazilian%20%28360-364%29&g=0400000US25&tid=ACSSPP1Y2019.S0201&hidePreview=false. Acesso em: 1 out. 2021.

VAN DER LELY, A. J. et al. Biological, physiological, pathophysiological, and pharmacological aspects of ghrelin. **Endocrine Reviews**, v. 25, n. 3, p. 426–457, jun. 2004.

WEISS, R.; BREMER, A. A.; LUSTIG, R. H. What is metabolic syndrome, and why are children getting it?: Metabolic syndrome in children. **Annals of the New York Academy of Sciences**, v. 1281, n. 1, p. 123–140, abr. 2013.

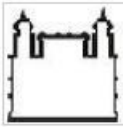
WHO. **Definition, Diagnosis and Classification of Diabetes Melittus and its Complications. Part 1:** Diagnosis and Classification of Diabetes Melittus. Geneva: World Health Organization, Department of Noncommunicable Disease Surveillance, 1999. Disponível em: http://apps.who.int/iris/bitstream/handle/10665/66040/WHO_NCD_NCS_99.2.pdf;jsessionid=64044E1F8FB395A64D713A114493B00D?sequence=1. Acesso em: 5 abr. 2019.

WREN, A. M. et al. Ghrelin enhances appetite and increases food intake in humans. **The Journal of Clinical Endocrinology and Metabolism**, v. 86, n. 12, p. 5992, dez. 2001.

XU, S. et al. The association between obstructive sleep apnea and metabolic syndrome: a systematic review and meta-analysis. **BMC Pulmonary Medicine**, v. 15, n. 1, dez. 2015.

ZIMMET, P. et al. The metabolic syndrome: a global public health problem and a new definition. **Journal of Atherosclerosis and Thrombosis**, v. 12, n. 6, p. 295–300, 2005.

ANEXO A – APROVAÇÃO CEP ENSP



ESCOLA NACIONAL DE SAÚDE PÚBLICA SERGIO AROUCA - ENSP/ FIOCRUZ

PARECER CONSUBSTANCIADO DO CEP

DADOS DA EMENDA

Título da Pesquisa: Análise de tendência dos fatores de risco para a síndrome metabólica em relação aos distúrbios do sono em imigrantes brasileiros em Massachusetts - EUA

Pesquisador: Talita Monsores Paixão
Área Temática:
Versão: 3
CAAE: 15012319.3.0000.5240
Instituição Proponente: FUNDACAO OSWALDO CRUZ
Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 4.557.229

Apresentação do Projeto:
Este parecer refere-se a uma solicitação de emenda 1 com a seguinte justificativa: "Devido a pandemia de COVID-19, o projeto sofreu vários atrasos. O campus da UMass Boston
(universidade que recebeu a aluna no doutorado sanduíche) passou a funcionar apenas com ensino a distância desde março de 2020, tendo todas as atividades presenciais suspensas, o que prejudicou o andamento do projeto conforme planejado inicialmente. Por esse motivo, as modificações apresentadas nessa emenda foram necessárias devido a impossibilidade de acesso ao local de coleta de dados como havia sido proposto no projeto aprovado anteriormente. Buscando manter a proposta de estudar os imigrantes brasileiros que vivem em Massachusetts e analisar as condições crônicas de saúde nessa população, que se mostra tão relevante devido à limitação dessas informações, iniciamos articulação com o CHA, que é uma rede de hospitais em Massachusetts que atende muitos brasileiros anualmente, para obter autorização de acesso e análise dos dados de diagnósticos de brasileiros. Foi apenas no final do ano de 2020 que conseguimos a autorização ética do Institutional Review Board do hospital para a análise desses dados. Ressaltamos que o acesso e análise dos dados iniciarão apenas após a aprovação dessa emenda pelo CEP. As modificações foram realizadas: • No título o Para expressar melhor o objetivo do estudo e ficar de acordo com as mudanças feitas na metodologia. • Justificativa, objeto, pergunta,

Endereço: Rua Leopoldo Bulhões, 1480 - Térreo
Bairro: Manguinhos **CEP:** 21.041-210
UF: RJ **Município:** RIO DE JANEIRO
Telefone: (21)2598-2863 **Fax:** (21)2598-2863 **E-mail:** cep@ensp.fiocruz.br

hipóteses e objetivos o Mudanças na escrita para se adequar as modificações metodológicas que foram necessárias. • Metodologia o Para adequar o projeto a nova proposta de coleta e análise de dados (dados secundários) que foi necessária devido à pandemia de COVID-19 e impossibilidade de realizar abordagem dos sujeitos do estudo, conforme havia sido proposto anteriormente. Além dessas modificações, o cronograma, orçamento e as palavras-chave também sofreram modificações. A palavra-chave "padrão de sono" foi substituída por "distúrbios do sono" na plataforma Brasil. Todas as modificações realizadas nesse projeto
estão destacadas em amarelo nos arquivos Projeto_de_pesquisa_modificado_emenda, cronograma_emenda e orcamento_modificado_emenda e também foram realizadas na plataforma Brasil. Ressaltamos que por ter se tornado um estudo com base de dados secundários, não há mais uma instituição coparticipante."

A apresentação do projeto foi descrita no parecer consubstanciado de aprovação inicial número 3.456.176, emitido em 16/07/2019.

O projeto também recebeu os seguintes pareceres consubstanciados:
3.400.720, em 18/06/2019 (pendencias)

Objetivo da Pesquisa:
Segundo a pesquisadora:
Objetivo Primário:
Caracterizar a população de imigrantes brasileiros em Massachusetts e investigar a tendência temporal da correlação entre os fatores de risco para a síndrome metabólica e os distúrbios do sono nessa população.
Objetivo Secundário:
• Revisar sistematicamente a prevalência da síndrome metabólica e seus componentes em imigrantes latino-americanos nos EUA, em comparação com a população nascida nos EUA;
• Analisar o perfil socioeconômico, demográfico e de trabalho dos imigrantes brasileiros residentes em Massachusetts, EUA;
• Descrever o perfil de saúde dos imigrantes brasileiros em Massachusetts, EUA;
• Avaliar a tendência de comportamento dos fatores de risco para a síndrome metabólica em relação aos distúrbios do sono nos imigrantes brasileiros em Massachusetts, EUA.

Avaliação dos Riscos e Benefícios:

Segundo a pesquisadora:

"Riscos:

Risco de identificação dos participantes. Visando controlar este risco, o responsável pelo banco de dados não disponibilizará informações que possibilitem a identificação dos participantes. Os dados que serão recebidos serão utilizados a fim da obtenção dos objetivos previstos, após a aprovação do CEP, e serão mantidos sob confidencialidade.

Benefícios:

Fonte de informações sobre a saúde e sono de imigrantes brasileiros nos Estados Unidos, ainda pouco estudados em comparação aos demais grupos de imigrantes. Após a conclusão do estudo, ocorrerá a devolutiva dos resultados obtidos a comunidade de imigrantes brasileiros em Massachusetts através das mídias sociais."

Comentários e Considerações sobre a Pesquisa:

Apresentou todos os elementos necessários à apreciação ética da emenda.

Considerações sobre os Termos de apresentação obrigatória:

Os termos inicialmente de apresentação obrigatória foram descritos no parecer consubstanciado nº 3.456.176, emitido pelo CEP/ENSP em 16/07/2019.

Para a solicitação desta emenda, foram apresentados os seguintes termos:

-IRB_approval_letter.pdf

-Form_encaminhamento_emenda.pdf

-Folha_de_Rosto.pdf

-Lista_de_paises_participantes_da_pesquisa_emenda.docx

-Termo_de_autorizacao_para_uso_de_dados_secundarios.pdf

-TCUD_Talita_Monsores_Paixao.pdf

-Orcamento_modificado_emenda.docx

-Cronograma_emenda.docx

-Projeto_de_pesquisa_modificado_emenda.doc

Recomendações:

Não há.

Conclusões ou Pendências e Lista de Inadequações:

O CEP/ENSP considera que a presente emenda aprovada uma vez que não altera os objetivos do projeto e seus requisitos éticos, podendo ser implementada a partir da presente data de emissão deste parecer.

Considerações Finais a critério do CEP:

Em atendimento ao subitem II.19 da Resolução CNS nº 466/2012, cabe ao pesquisador responsável pelo presente estudo elaborar e apresentar relatórios parciais e final "[...] após o encerramento da pesquisa, totalizando seus resultados", em forma de "notificação". O modelo de relatório de CEP/ENSP se encontra disponível em www.ensp.fiocruz.br/etica.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_1700185_E1.pdf	22/02/2021 18:45:11		Aceito
Outros	IRB_approval_letter.pdf	22/02/2021 17:43:53	Talita Monsores Paixão	Aceito
Outros	Form_encaminhamento_emenda.pdf	22/02/2021 17:41:55	Talita Monsores Paixão	Aceito
Folha de Rosto	Folha_de_Rosto.pdf	22/02/2021 17:40:03	Talita Monsores Paixão	Aceito
Outros	Lista_de_paises_participantes_da_pesquisa_emenda.docx	19/02/2021 23:09:25	Talita Monsores Paixão	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	Termo_de_autorizacao_para_uso_de_dados_secundarios.pdf	19/02/2021 23:07:04	Talita Monsores Paixão	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCUD_Talita_Monsores_Paixao.pdf	19/02/2021 23:06:33	Talita Monsores Paixão	Aceito
Orçamento	Orcamento_modificado_emenda.docx	19/02/2021 23:05:57	Talita Monsores Paixão	Aceito

Cronograma	Cronograma_emenda.docx	19/02/2021 23:05:39	Talita Monsores Paixão	Aceito
Projeto Detalhado / Brochura Investigador	Projeto_de_pesquisa_modificado_emenda.doc	19/02/2021 23:05:22	Talita Monsores Paixão	Aceito
Outros	Declaracao_de_Coorientacao.pdf	09/07/2019 11:33:05	Talita Monsores Paixão	Aceito
Declaração de Pesquisadores	Carta_do_professor_Carlos_Eduardo_Siqueira.pdf	09/07/2019 11:31:20	Talita Monsores Paixão	Aceito
Outros	Aprovacao_para_doutorado_sanduiche.pdf	09/07/2019 11:30:06	Talita Monsores Paixão	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

RIO DE JANEIRO, 24 de Fevereiro de 2021

Assinado por:
Jennifer Braathen Salgueiro
(Coordenador(a))

ANEXO B – APROVAÇÃO INSTITUTIONAL REVIEW BOARD DO CAMBRIDGE HEALTH ALLIANCE

CHA Cambridge Health Alliance

NOTICE OF IRB EXEMPTION GRANTED
(2018 Revised Common Rule Requirements)

November 30, 2020

Elisa Tristan-Cheever, MPH
Infection Control Department
1493 Cambridge Street, Macht Rm 244
Cambridge, M A 02139

Study Title: Health Profile of Brazilian Patients in Massachusetts
Date of Review: 11/25/20
Action: Exemption granted, 45 CFR 46.104(d)(Category 4 (iii))
HIPAA: Limited Data Set
Documents Dated/Received: 11/26/20
Clinical Trial Registration NCT #: N/A

Dear Dr. Tristan-Cheever,

I have reviewed the above-referenced submission and determined that it qualifies for exemption.

FOR FUNDED STUDIES: RESEARCH MUST NOT BEGIN WITHOUT AUTHORIZATION FROM THE OFFICE FOR SPONSORED RESEARCH.

Provided you do not make any change to the study, additional review by the IRB is not required. However, any proposed change to this project must be reviewed by the IRB prior to implementation so that it may be determined whether the proposed change(s) is within the parameters of the current exemption. The exempt status of this research will not expire. Please notify the IRB office in writing when this project is terminated.

The HIPAA Privacy and Security Rule apply to this study. If you create, receive, store, or transmit electronic PHI you must meet institutional Security Rule standards. Please also be reminded that this study may be audited periodically by the CHA Research Quality Assurance/Quality Improvement program.

Please direct questions and future submissions to CHAIRBOffice@challiance.org or 617-806-8702.

Thank you.

Sincerely,

[redacted]

Lior Givon, MD, PhD
Chair, Institutional Review Board

AFFILIATED WITH:
Beth Israel Deaconess Medical Center · MassGeneral Hospital for Children · HARVARD MEDICAL SCHOOL TEACHING HOSPITAL · Tufts School of Medicine

ANEXO C – AUTORIZAÇÃO DE ACESSO AOS DADOS

CHA Cambridge Health Alliance

HARVARD MEDICAL SCHOOL TEACHING HOSPITAL

Termo de autorização para uso de banco de dados secundários

Boston, 10 de dezembro de de 2020.

Eu, Elisa Tristan-Cheever, Infection Prevention Liaison , autorizo na qualidade de coordenadora do projeto: Health Profile of Brazilian Patients in Massachusetts a aluna Talita Monsores Paixão, do doutorado acadêmico em Saúde Pública e Meio Ambiente, da Escola Nacional de Saúde Pública Sérgio Arouca, a utilizar os dados do referido estudo.

Isso inclui acesso ao banco de dados do projeto, de forma que atenda aos seus objetivos na construção de sua tese. O projeto fora aprovado pelo Institutional Review Board do Cambridge Health Alliance, conforme carta em anexo.

Att.

[redacted]

Dra. Elisa Tristan-Cheever, MPH
Coordenadora da pesquisa