

**ANALISA HUBUNGAN KUALITAS TIDUR DENGAN
KUALITAS HIDUP PADA DIABETES MELLITUS
BERDASARKAN STUDI LITERATUR**

SKRIPSI



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**PROGRAM STUDI S1 ILMU KEPERAWATAN
FAKULTAS ILMU KESEHATAN
UNIVERSITAS dr. SOEBANDI
2021**

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Untuk Memenuhi Persyaratan
Memperoleh Gelar S1 Ilmu Keperawatan



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Hasil penelitian ini telah diperiksa oleh pembimbing dan telah disetujui untuk mengikuti seminar hasil pada Program Studi Sarjana Ilmu Keperawatan Universitas dr. Soebandi

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Menyatakan dengan sesungguhnya bahwa *literatur review* saya yang berjudul “Analisa Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Diabetes Mellitus Berdasarkan Studi Literatur” adalah benar-benar karya saya sendiri, kecuali kutipan yang sudah disebutkan sumbernya dan belum pernah diajukan sebagai syarat penelitian, baik di Universitas dr. Soebandi Jember maupun di perguruan tinggi lain. Saya bertanggung jawab atas keabsahan dan kebenaran isinya sesuai dengan sikap ilmiah yang dijunjung tinggi.

Demikian pernyataan ini saya buat dengan sebenarnya, tanpa ada tekanan dan paksaan dari pihak manapun serta bersedia mendapat sanksi akademik jika dikemudian hari ini tidak benar.

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Yang menyatakan



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HALAMAN PEMBIMBING

SKRIPSI

**ANALISA HUBUNGAN KUALITAS TIDUR DENGAN KUALITAS HIDUP
PADA DIABETES MELLITUS BERDASARKAN STUDI LITERATUR**

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*Agar sukses, kemauanmu untuk berhasil harus lebih besar dari ketakutanmu
untuk gagal*

(Bill Cosby)

Bila kita takut akan kegagalan, berarti kita telah membatasi kemampaun kita

(Henry Ford)

*Bersyukurlah dengan apa yang saat ini kita raih, jika tidak puas maka teruslah
berusaha, namun tetap bersyukur*

(Renita Ulfi Afidah)

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Dalam penyusunan Skripsi ini penulis menyadari masih jauh dari kesempurnaan, untuk itu penulis sangat mengharapkan kritik dan saran untuk perbaikan di masa mendatang.

Jember, 28 Juli 2021



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ABSTRAK

Afidah, Renita Ulfi*. Prasetyo, Hendro**. Wirasakti, Guruh***. 2021. **Analisa Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Diabetes Mellitus Berdasarkan Studi Literatur**. Program Studi Ilmu Keperawatan Universitas dr. Soebandi Jember.

Diabetes mellitus (DM) saat ini menjadi masalah utama yang memiliki kualitas hidup rendah. Kualitas hidup buruk atau rendah akibat adanya gangguan tidur bahkan kualitas tidur yang buruk. Tujuan Penelitian ini adalah untuk menganalisis hubungan kualitas tidur dengan kualitas hidup pada diabetes mellitus berdasarkan studi literatur. **Metode:** penelitian ini menggunakan *Studi Literatur Review* dengan desain *Crossectional* dengan metode pengumpulan artikel menggunakan database *ProQuest, Science Direct, Pubmed, Research Gate*, dan *google scholar*. Kemudian dikategorikan berdasarkan kriteria inklusi, lalu didapatkan 10 jurnal yang sesuai dengan kriteria inklusi yang akan dilakukan review. **Hasil:** dari hasil review kesepuluh artikel yang didapatkan, 50% memiliki kualitas tidur yang buruk, lebih dari 50% memiliki kualitas hidup yang buruk pada diabetes mellitus dan menunjukkan ada hubungan yang signifikan antara kualitas tidur dengan kualitas hidup pada penderita diabetes mellitus. **Diskusi:** penderita diabetes mellitus perlu manajemen dan kontrol diri yang baik, mengikuti pola hidup sehat dan memenuhi kebutuhan dasar seperti tidur yang cukup dan berkualitas.

Kata Kunci : Kualitas Tidur, Kualitas Hidup, Diabetes Mellitus

* Peneliti

**Pembimbing I

***Pembimbing II

ABSTRACT

Afidah, Renita Ulfi *. Prasetyo, Hendro**. Wirasakti, Guruh ***. 2021. **Analysis of the Relationship between Sleep Quality and Quality of Life in Diabetes Mellitus Based on Literature Studies.** Nursing Science Study Program University of dr. Soebandi Jember.

Diabetes mellitus (DM) is currently a major problem with low quality of life. Poor or low quality of life due to sleep disturbances and even poor sleep quality. The purpose of this study was to analyze between sleep quality and quality of life in diabetes mellitus based on a literature study. **Methods:** this study uses a literature review study with a cross-sectional design with article collection methods using the *ProQuest, Science Direct, Pubmed, Research Gate*, dan *google scholar*. Then categorized based on the inclusion criteria, then 10 journals that match the inclusion criteria will be reviewed. **Results:** from the results of a review of the ten articles obtained, 50% have poor sleep quality, more than 50% have poor quality of life in diabetes mellitus and show there is a significant relationship between sleep quality and quality of life in people with diabetes mellitus. **Discussion:** people with diabetes mellitus need good self-management and control, follow a healthy lifestyle and fulfill basic needs such as adequate and quality sleep.

Keywords: Sleep Quality, Quality Of Life, Diabetes Mellitus

* Researcher

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DAFTAR SINGKATAN

ADA	: American Diabetes Association
DM	: Diabetes Mellitus
GDM	: Diabetes Mellitus Gastasional
IDDM	: Insulin Dependent Diabetes Mellitus
IDF	: Internasional Diabetes Federation
Kemenkes	: Kementrian Kesehatan
NIDDM	: Non-Insulin Dependent Diabetes Mellitus
NREM	: Non-Rapit Eye Movement
PSQI	: Pittsburgh Sleep Quality Index
Riskesdes	: Riset Kesehatan Dasar
REM	: Rapit Eye Movement
RLS	: Restless Legh Syndrome
UHP	: Umur Harapan Hidup
WHOQOL-BREF	: World Health Organization Quality Of Life-BREF

BAB I

PENDAHULUAN

1.1 Latar Belakang

Diabetes mellitus (DM) merupakan suatu penyakit kronis yang saat ini masih menjadi masalah yang utama dalam dunia kesehatan. Diabetes mellitus dapat menyerang pada semua golongan masyarakat di seluruh dunia. Jumlah penderita diabetes mellitus terus bertambah dari tahun ketahun, hal itu dapat berdampak pada menurunnya umur harapan hidup (UHP), penurunan kualitas hidup, serta meningkatnya angka kematian (Nwankwo et al, 2010)

Internasional Diabetes Federation (IDF) Atlas 2017 menyatakan bahwa penderita diabetes mellitus di Indonesia masih cenderung meningkat. Indonesia merupakan negara yang menduduki peringkat keenam di dunia setelah Tiongkok, India, Amerika Serikat, Brazil, dan Meksiko dengan jumlah penderita diabetes mellitus usia 20-79 tahun sekitar 10,3 juta orang. Hasil Riset Kesehatan Dasar (Riskesdas) tahun 2018 menunjukkan prevelensi diabetes mellitus berdasarkan diagnosis dokter pada rentang usia 55-64 tahun menempati posisi tertinggi sebesar 6,3%, dan usia 65-74 tahun adalah sebesar 6,0%. Prevelensi diabetes mellitus berdasarkan hasil pengukuran kadar glukosa darah pada penduduk umur ≥ 15 tahun adalah 10,6% (Kementrian Kesehatan RI, 2018). Provinsi Jawa Timur prevalensi penderita diabetes mellitus yang terdiagnosa dokter

pada penduduk dengan semua umur adalah sebesar 1,25% (Kementrian Kesehatan RI, 2018). Pada pasien rawat jalan dengan penyakit diabetes mellitus di Kabupaten Jember mencapai 17,49% dan menduduki peringkat ketiga setelah penyakit ISPA dan hipertensi primer (Dinas Kesehatan Kabupaten Jember, 2014)

Diabetes Mellitus (DM) merupakan suatu penyakit gangguan metabolik yang disebabkan oleh rusaknya organ pankreas sehingga dapat menyebabkan insulin yang dihasilkan oleh tubuh tidak cukup untuk memenuhi kebutuhan tubuh (Kemenkes, 2014). Diabetes mellitus memiliki tiga gejala klasik yang sering terjadi yaitu, polyuria, polydipsia, polyphagia. Selain itu terdapat beberapa gejala lain seperti mengantuk, cepat lelah, dan mual muntah (Novitasari, 2012). Sifat alamiah dari penyakit dapat mencegah individu untuk mendapatkan istirahat yang cukup (Potter & Perry, 2013). Beberapa penelitian menunjukkan satu dari tiga penderita DM tipe 2 mengalami gangguan tidur. Gangguan tidur yang biasanya terjadi pada DM akan menyebabkan adanya penurunan pada kualitas tidurnya. Kualitas tidur merupakan suatu fenomena yang sangat kompleks yang melibatkan beberapa domain yaitu, penilaian terhadap berapa lama waktu tidur, apakah ada gangguan saat tidur, masa laten tidur, disfungsi tidur pada saat siang hari, efisiensi tidur, kualitas tidur, penggunaan obat tidur. Jadi apabila satu dari ketujuh domain tersebut mengalami gangguan maka akan mengakibatkan terjadinya penurunan kualitas tidur (Indarwati, 2012). Pasien DM umumnya mengalami

gangguan kualitas tidur dikarenakan sering terbangun di malam hari untuk ke kamar mandi atau merasa haus sehingga kualitas tidurnya terganggu. Gangguan kualitas tidur jika terjadi terus menerus akan berdampak pada penurunan kualitas hidup penderita DM (Fitri, 2015).

Kualitas hidup (*quality of life*) yaitu perasaan individu tentang kesehatan dan kesejahteraannya dalam area yang luas meliputi fungsi fisik, fungsi psikologis dan fungsi sosial (Yusra, 2010). Penelitian yang dilakukan oleh spasic et al (2014) menunjukkan bahwa orang yang menderita diabetes mellitus memiliki kualitas hidup yang rendah dibandingkan dengan orang yang tidak menderita diabetes mellitus.

Kualitas hidup DM dipengaruhi oleh beberapa faktor yaitu, usia, jenis kelamin, tingkat pendidikan, lama menderita diabetes mellitus dan komplikasi diabetes mellitus. Selain itu, Peian Lou et al (2014), juga menemukan faktor-faktor yang dapat mempengaruhi kualitas hidup yaitu, lama durasi menderita DM, komplikasi, kontrol gula darah yang rendah, menderita depresi, ansietas serta kualitas tidur yang buruk. Pengukuran kualitas hidup bersifat multidimensi yang meliputi fungsi fisik, psikologis, sosial, lingkungan dan kualitas hidup secara umum. Pada penderita DM dikatakan memiliki kualitas hidup yang baik apabila memiliki kondisi fungsional yang optimal, sehingga dapat menikmati kehidupannya dengan penuh makna, bahagia dan berguna (Akhmadi, 2019)

1.2 Rumusan Masalah

Bagaimana hubungan kualitas tidur dengan kualitas hidup pada penderita Diabetes Mellitus berdasarkan studi literature?

1.3 Tujuan Penelitian

1.3.1 Tujuan Umum

Tujuan dari penelitian ini untuk menganalisis hubungan kualitas tidur dengan kualitas hidup pada penderita Diabetes Mellitus berdasarkan studi literature

1.3.2 Tujuan Khusus

1. Menjelaskan kualitas tidur dari artikel-artikel berbagai jurnal
2. Menjelaskan kualitas hidup pada penderita Diabetes Mellitus dari artikel-artikel berbagai jurnal
3. Menjelaskan secara deskriptif hubungan kualitas tidur dengan kualitas hidup pada penderita Diabetes Mellitus dari artikel-artikel berbagai jurnal

BAB II

TINJAUAN PUSTAKA

2.1 Konsep Tidur

2.1.1 Definisi Tidur

Tidur merupakan suatu proses yang berhubungan dengan mata yang tertutup selama beberapa periode sehingga memberikan istirahat total terhadap aktivitas sehari-hari dan juga istirahat mental, kecuali beberapa fungsi organ vital seperti jantung, paru-paru, hati, sirkulasi darah, dan organ dalam lainnya (Santhi; Mukunthan A, 2013). Istirahat atau tidur adalah suatu kebutuhan dasar yang dibutuhkan semua orang (Dewi, 2019). Setiap individu membutuhkan tidur yang cukup agar tubuh dapat berfungsi normal, pada saat istirahat atau tidur tubuh akan terjadi suatu proses pemulihan yang bertujuan untuk mengembalikan stamina atau kesegaran tubuh sehingga kondisi tubuh kembali optimal (Dewi, 2019).

2.1.2 Tahapan Tidur

Tidur dapat didefinisikan dengan berdasarkan kriteria perilaku dan kriteria fisiologis dapat dibagi menjadi dua keadaan yaitu, tidur *non rapid eye movement* (NREM) yang dibagi menjadi empat tahap (tahap I, tahap

II, tahap III, tahap IV) dan tidur *rapid eye movement* (REM) yang ditandai dengan gerakan mata yang cepat (Santhi; Mukunthan A, 2013)

1. Tahap NREM (*non rapid eye movement*)

Tidur NREM sering juga disebut sebagai tidur tanpa dengan mimpi. Namun sebenarnya pada tahap tidur NREM sering terjadi sebuah mimpi dan terkadang dapat terjadi sebuah mimpi yang buruk selama tidur pada tahap ini. Biasanya sebuah mimpi pada tahap tidur ini tidak bisa diingat karena terjadi suatu konsolidasi di dalam memori (Guyton, 2014).

a. Tahap I

Pada tahap I NREM merupakan suatu tahap yang paling ringan dari tahapan tidur. Selama tahap tidur ini, mata akan tertutup dan dianggap sebagai periode transisi antara terjaga dan tidur. Seorang individu dapat mengalami gerakan yang tersentak secara tiba-tiba pada kaki atau pada otot-otot lainnya dan juga bisa mendapatkan sensasi seperti rasa yang terjatuh, hal ini dikenal dengan *myoclonic hypnic*. Pada tahap ini dapat berlangsung selama sekitar 10 hingga 15 menit (Santhi; Mukunthan A, 2013).

b. Tahap II

Pada tahap II NREM dapat berlangsung selama sekitar 20 menit. Selama tahap II ini gerakan mata akan berhenti dan aktifitas

otak akan menjadi lebih lambat, serta pada tahap ini suhu dalam tubuh akan menurun dan detak jantung akan mulai melambat (Santhi; Mukunthan A, 2013).

c. Tahap III

Pada tahap III NREM ini denyut jantung, frekuensi pernafasan dan keadaan didalam tubuh lainnya akan mengalami penurunan karena dominasi sistem saraf parasimpatik. Pada tahap ini juga tidur seseorang akan lebih sulit untuk dibangunkan (Kozier, 2010).

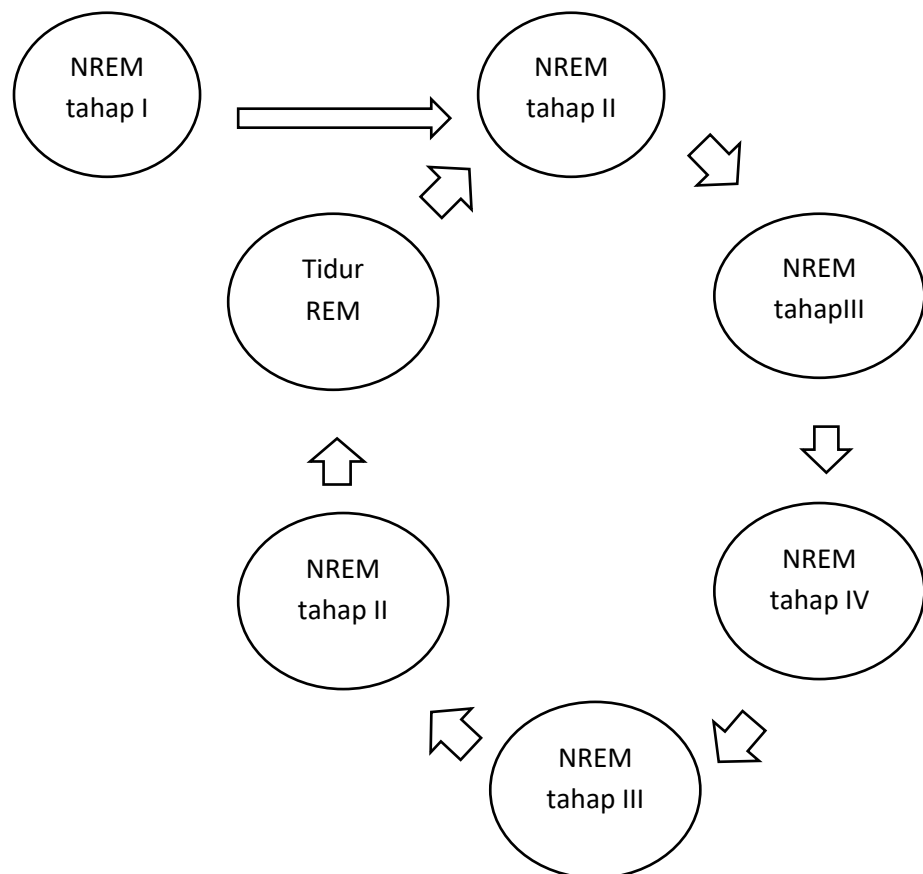
d. Tahap IV

Pada tahap IV NREM ini menandai tidur yang sangat dalam yang disebut juga tidur delta. Denyut jantung dan frekuensi pernafasan pada seseorang yang tidur akan menurun sebesar 20% sampai 30%, dibandingkan dengan denyut jantung dan frekuensi pernafasan pada seseorang yang terjaga atau bangun (Kozier, 2010).

2. Tahap REM (*rapid eye movement*)

Pada tidur REM aktivitas otak akan menjadi aktif dengan disertai dengan mimpi yang biasanya sekitar 80% pada tahap tidur REM. Biasanya lebih mudah untuk mengingat mimpi. Mimpi pada tahap ini sering jelas, tidak realistis, dan terkadang aneh (Chokroverty,

2010). Tidur pada tahap REM sangat penting dalam memelihara fungsi kognitif dikarenakan tidur pada tahap ini akan melancarkan aliran darah ke otak, meningkatkan aktifitas korteks, serta meningkatkan pengeluaran epinefrin. Tidur Rem yang adekuat berperan dalam mengorganisasi informasi, proses belajar, dan menyimpan memori jangka panjang (Arifin, 2011)



Gambar 2.1 Siklus Tidur

Saat tidur seseorang akan melewati tahap tidur NREM dan REM. Siklus yang komplet biasanya berlangsung sekitar 1,5 jam pada orang

dewasa. Siklus tidur yang pertama, seseorang akan melalui tahap I, tahap II, tahap III pada tahap NREM dengan total waktu sekitar 20 sampai 30 menit. Kemudian, tahap IV pada NREM yang berlangsung sekitar 30 menit. Setelah tahap IV, tidur akan kembali ke tahap III dan tahap II dengan waktu sekitar 20 menit. Selanjutnya akan memasuki tahap REM yang berlangsung sekitar 10 menit. Saat tidur biasanya seseorang akan mengalami kira-kira empat sampai 6 siklus tidur yang berlangsung selama 7-8 jam. Jika seseorang yang dibangunkan pada saat tidur ditahap manapun, kemudian pada saat orang tersebut akan memulai kembali untuk tidur maka akan dimulai dari tahap I pada NREM dan berlanjut ke seluruh tahap tidur REM (Kozier, 2010).

2.1.3 Definisi Kualitas Tidur

Kualitas tidur merupakan kemampuan seorang individu untuk tetap tertidur dan mendapatkan tahapan tidur NREM dan REM yang pas atau cukup (Kozier, 2010). Kualitas tidur merupakan suatu fenomena yang sangat kompleks yang melibatkan beberapa domain yaitu, penilaian terhadap berapa lama waktu tidur, apakah ada gangguan saat tidur, masa laten tidur, disfungsi tidur pada saat siang hari, efisiensi tidur, kualitas tidur, penggunaan obat tidur. Jadi apabila satu dari ketujuh domain tersebut mengalami gangguan maka akan mengakibatkan terjadinya penurunan kualitas tidur (Indarwati, 2012).

Pada penilaian terhadap lama waktu tidur yang dinilai adalah waktu dimana dari tidur yang sebenarnya yang dialami seseorang pada malam hari. Penilaian ini dibedakan dengan waktu yang dihabiskan di tempat tidur. Penilaian pada gangguan tidur dinilai dari apakah seseorang terbangun pada tengah malam atau bangun pagi terlalu cepat, bangun untuk pergi ke kamar mandi, sulit bernafas secara nyaman, batuk dan mendengkur keras, merasa kedinginan, merasa kepanasan, mengalami mimpi buruk, merasa sakit dan alasan lain yang dapat mengganggu tidur (Buysse. et al, 1989)

Penilaian terhadap masa laten tidur dinilai dari berapa menit yang dihabiskan seseorang di tempat tidur sebelum akhirnya dapat tertidur dan apakah seseorang tersebut tidak dapat tidur selama 30 menit. Penilaian terhadap disfungsi tidur pada siang hari dinilai dari waktu sebulan yang lalu, apakah sering timbul masalah yang mengganggu seseorang tetap terjaga sadar saat mengendarai kendaraan, makan, beraktivitas sosial, serta dinilai juga dari berapa banyak masalah yang membuat seseorang tidak antusias untuk menyelesaikannya dalam sebulan. Penilaian terhadap efisiensi tidur dinilai dari waktu seseorang biasanya memulai tidur pada malam hari selama sebulan dan waktu seseorang biasanya bangun di pagi hari selama sebulan. Penilaian terhadap penggunaan kualitas tidur hanya ditunjukkan pada penilaian seberapa sering seseorang mengkonsumsi obat-obatan yang dapat membantu tidur dalam sebulan lalu (Buysse. et al, 1989)

Kualitas tidur dikatakan baik apabila seseorang tidak menunjukkan berbagai tanda kekurangan tidur dan juga tidak mengalami masalah dalam tidurnya (Nilifda, 2016). Kualitas tidur akan dikatakan buruk jika seseorang mengalami kesulitan untuk tidur dan seringkali terbangun di malam hari atau pada dini hari (Putra, 2011)

2.1.4 Faktor-Faktor yang Mempengaruhi Kualitas Tidur

Faktor-faktor yang dapat mempengaruhi seorang individu dalam bisa atau tidaknya untuk tidur antara lain :

1. Status kesehatan

Seorang individu dengan kondisi tubuh yang sehat dapat memungkinkan tidur dengan nyenyak, sedangkan jika seseorang dengan kondisi tubuhnya yang kurang sehat atau sakit dan rasa nyeri memungkinkan kebutuhan tidurnya akan tidak nyenyak (Chen et al, 2016).

2. Lingkungan

Lingkungan bahkan dapat menghalangi atau meningkatkan seseorang untuk tidur. Lingkungan yang bersih, memiliki suhu yang dingin, suasanya yang tenang dan dengan penerangan yang tidak terlalu terang akan membuat tidur seorang individu nyenyak. Sedangkan jika lingkungan dalam keadaan kotor, memiliki suhu panas,

suasanya yang ramai dan penerangan yang sangat terang atau terlalu redup dapat mempengaruhi kualitas tidur pada seorang individu (Chen et al, 2016).

3. Stress psikologis

Cemas dan juga depresi dapat menyebabkan gangguan pada frekuensi tidur seorang individu. Hal ini disebabkan karena kondisi cemas dapat meningkatkan norepinefrin darah melalui system saraf simpatis. Zat ini dapat mengurangi tidur pada tahap IV NREM dan tidur tahap REM (Chen et al, 2016).

4. Diet

Makanan yang banyak mengandung L-Triptofan seperti keju, ikan tuna, dan susu dapat menyebabkan seorang individu dengan mudah akan tertidur. Sebaliknya jika seorang individu mengkonsumsi minuman yang mengandung kafein ataupun alkohol akan menyebabkan seorang individu akan sulit untuk tidur atau tidur dapat terganggu (Chen et al, 2016).

5. Gaya hidup

Kelelahan yang dirasakan oleh seorang individu dapat mempengaruhi kualitas tidur seseorang. Kelelahan dengan tingkat menengah masih dapat tidur dengan nyenyak. Sedangkan jika seorang

individu memiliki kelelahan yang berlebih akan menyebabkan periode tidur REM lebih pendek (Chen et al, 2016).

6. Obat-obatan

Obat-obatan yang dikonsumsi oleh seorang individu ada yang memiliki efek yang dapat menyebabkan seseorang dengan mudah tertidur, adapula yang sebaliknya yaitu dapat mengganggu tidur seorang individu. Obat dan manipulasi yang dapat meningkatkan pencetusan neuron noredrenergik, hal ini yang dapat menimbulkan pengurangan tidur REM dan dapat meningkatkan keadaan terjaga (Chen et al, 2016).

2.1.5 Pengukuran Kualitas Tidur

Kualitas tidur dapat diukur dengan menggunakan *Pittsburgh sleep quality index (PSQI)*. Questioner PSQI terdiri dari 9 pertanyaan. Skala pengukuran menggunakan rating scala yaitu skor 0-3. Hasil dalam pengukuran keseluruhan adalah 0-21 yang diperoleh dari 7 komponen penilaian yang diantaranya kualitas tidur secara subjektif, waktu yang diperlukan untuk memulai tidur (sleep latency), lamanya waktu tidur (sleep duration), efisiensi tidur ((habitual sleep efficiency), gangguan tidur yang sering dialami pada malam hari (sleep disturbance), penggunaan obat untuk membantu tidur ((using medication), dan gangguan tidur yang sering dialami pada siang (daytime disfunction). Semakin tinggi skor nilai

maka akan semakin buruk kualitas tidurnya. seseorang diaktakan baik memiliki kualitas tidur yang baik bila skor nilai 1-5, ringan 6-7, sedang 8-14, dan kualitas tidur yang buruk jika skor nilai mencapai 15-21 (Sukmawati et al, 2019).

2.2 Diabetes Mellitus

2.2.1 Pengertian Diabetes Mellitus

Diabetes Mellitus (DM) merupakan suatu penyakit gangguan metabolik yang disebabkan oleh rusaknya organ pankreas sehingga dapat menyebabkan insulin yang dihasilkan oleh tubuh tidak cukup untuk memenuhi kebutuhan tubuh (Kemenkes, 2014). Diabetes Mellitus merupakan penyakit menahun yang biasanya ditandai dengan kadar gula dalam darah melebihi dari normal yaitu kadar gula dalam darah sewaktu lebih dari atau sama dengan 200 mg/dl, dan kadar gula darah puasa di atas atau sama dengan 130 mg/dl (Padila, 2013)

Menurut *American Diabetes Association* (ADA) 2010, Diabetes Mellitus merupakan penyakit metabolic yang menyebabkan hiperglikemia karena terjadi suatu kelainan pada sekresi insulin, kerja insulin, atau bisa juga kedua-duanya.

2.2.2 Klasifikasi Diabetes Mellitus

Klasifikasi diabetes mellitus sebagai berikut :

1. Tipe I : Diabetes mellitus tergantung insulin (IDDM)

IDDM adalah penyakit hiperglikemi akibat ketidakabsolutan insulin, pengidap penyakit itu harus mendapatkan insulin pengganti. IDDM disebabkan oleh destruksi autoimun karena infeksi, biasanya virus dan/atau respon autoimun secara genetic pada orang yang terkena (Padila, 2019).

2. Tipe II : Diabetes mellitus tidak tergantung insulin (NIDDM)

NIDDM disebabkan oleh kegagalan relative sel beta dan resistensi insulin. Resistensi insulin adalah turunnya kemampuan insulin untuk merangkum pengambilan glukosa oleh gangguan perifer dan untuk menghambat produksi glukosa oleh hati. Sel beta tidak mampu mengimbangi resistensi insulin ini sepenuhnya (Padila, 2019).

3. Diabetes mellitus tipe lain

Beberapa diabetes tipe lain seperti defek genetik fungsi sel beta, defek genetik kerja insulin, penyakit eksokrin pankreas, endokrinopati, karena obat/zat kimia, infeksi, penyebab imunologi yang jarang, dan sindrom genetik lain yang berkaitan dengan DM (Padila, 2019).

4. Diabetes mellitus gestasional (GDM)

Diabetes yang terjadi pada saat kehamilan ini adalah intoleransi glukosa yang mulai timbul atau menular diketahui selama keadaan hamil. Oleh karena terjadi peningkatan sekresi berbagai hormone disertai pengaruh metabolik terhadap glukosa, maka kehamilan merupakan keadaan peningkatan metabolik tubuh dan hal ini berdampak kurang baik bagi janin (Padila, 2019).

2.2.3 Etiologi Diabetes Mellitus

1. Diabetes tipe I : (Padila, 2019)

a. Faktor genetik

Penderita diabetes tidak mewarisi diabetes tipe I itu sendiri; tetapi mewarisi suatu predisposisi atau kecenderungan genetik ke arah terjadinya DM tipe I. Kecenderungan genetik ini ditemukan pada individu yang memiliki tipe antigen HLA (Padila, 2019).

b. Faktor-faktor imunologi

Adanya respons otoimun yang merupakan respons abnormal dimana antibody terarah pada jaringan normal tubuh dengan cara bereaksi terhadap jaringan tersebut yang dianggapnya seolah-olah sebagai jaringan asing. Yaitu otoantibodi terhadap sel-sel pulau Langerhans dan insulin endogen (Padila, 2019).

c. Faktor lingkungan

Virus atau toksin tertentu dapat memicu proses otoimun yang menimbulkan destruksi sel beta

d. Penurunan sel beta

e. Proses radang, keganasan pankreas, pembedahan

f. Kehamilan

g. Infeksi lain yang tidak berhubungan langsung

2. Diabetes tipe II :

Mekanisme yang tepat yang dapat menyebabkan resistensi insulin dan gangguan sekresi insulin pada diabetes tipe II masih belum diketahui. Faktor genetic memegang peranan dalam proses terjadinya resistensi insulin (Padila, 2019). Faktor-faktor resiko : (Padila, 2019)

a. Usia (resistensi insulin cenderung meningkat pada usia di atas 65 th)

b. Obesitas

c. Riwayat keluarga

d. Gaya hidup

2.2.4 Faktor Resiko Diabetes Mellitus Secara Umum

Faktor-faktor resiko yang dapat menyebabkan Diabetes Mellitus secara umum yaitu : (Ali, 2016).

1. Mempunyai keturunan diabetes
2. Kegemukan
3. Jarang olahraga
4. Telah teridentifikasi mempunyai kadar gula tinggi
5. Lahir dengan berat badan lebih dari 4 kg
6. Riwayat tekanan darah tinggi
7. Kadar lemak tinggi
8. Mempunyai riwayat gangguan organ jantung

2.2.5 Tanda dan Gejala Diabetes Mellitus

1. Banyak kencing (poliuria)

Oleh karena sifatnya, kadar glukosa darah yang tinggi akan menyebabkan banyak kencing (Ali, 2016).

2. Banyak minum (polidipsia)

Oleh karena sering kencing maka memungkinkan sering haus dan banyak minum (Ali, 2016).

3. Banyak makan (polifagia)

Penderita diabetes mellitus mengalami keseimbangan kalori negatif, sehingga timbul rasa lapar yang sangat besar (Ali, 2016).

4. Penurunan berat badan dan rasa lemah

Hal ini disebabkan glukosa dalam darah tidak dapat masuk ke dalam sel, sehingga sel kekurangan bahan bakar untuk menghasilkan tenaga. Untuk kelangsungan hidup, sumber tenaga terpaksa diambil dari cadangan lain, yaitu sel lemak dan otot. Akibatnya penderita kehilangan jaringan lemak dan otot sehingga menjadi kurus (Ali, 2016).

5. Keluhan lain : (Ali, 2016)

- a. Gangguan saraf tepi
- b. Gangguan penglihatan
- c. Gatal/bisul
- d. Gangguan ereksi

2.2.6 Komplikasi Kronis Diabetes Mellitus

Komplikasi kronis yang sering terjadi pada Diabetes Mellitus yaitu : (Ali, 2016).

- 1. Mata : retinopati diabetik, katarak

2. Ginjal : glomerulosklerosis intrakapiler, infeksi
3. Saraf : neuropati perifer, neuropati kranial, neuropati otonom
4. Kulit : dermatopati diabetik, nekrobiosis lipoidika diabetikorum, kandidiasis, tukak kaki dan tungkai
5. System kardiovaskular : penyakit jantung dan gangrene pada kaki
6. Infeksi tidak lazim : fasilitis dan myositis nekrotikans, meningitis mucor, kolesistitis emfisematosa, otitis eksterna maligna

2.2.7 Penatalaksanaan Diabetes Mellitus

Tujuan penatalaksanaan Diabetes Mellitus secara umum adalah untuk meningkatkan kualitas hidup penyandang Diabetes Mellitus. Tujuan penatalaksanaan meliputi : (Perkeni, 2015)

1. Tujuan jangka pendek : menghilangkan keluhan Diabetes Mellitus, memperbaiki kualitas hidup, dan mengurangi resiko komplikasi akut
2. Tujuan jangka panjang : mencegah dan menghambat progresivitas penyulit mikroangiopati dan makroangiopati
3. Tujuan akhir pengelolaan adalah turunya morbiditas dan mortalitas pada Diabetes Mellitus

Penatalaksanaan Diabetes Mellitus dimulai dengan menerapkan pola hidup sehat (terapi nutrisi, medis dan aktifitas fisik) bersamaan dengan intervensi farmakologi dengan obat anti hiperglikemia secara oral atau dengan suntikan (Perkeni, 2015).

1. Edukasi

Edukasi dengan tujuan promosi hidup sehat, perlu selalu dilakukan sebagai bagian dari upaya pencegahan dan merupakan bagian yang sangat penting dari pengelolaan Diabetes Mellitus secara holistic (Perkeni, 2015).

2. Terapi nutrisi

Terapi nutrisi medis merupakan bagian penting dari penatalaksanaan Diabetes Mellitus tipe 2 secara komprehensif. Kunci keberhasilannya adalah keterlibatan secara menyeluruh dari anggota tim (dokter, ahli gizi, petugas kesehatan lainnya serta penderita dan keluarganya). Prinsip pengaturan makan pada penderita Diabetes Mellitus hampir sama dengan anjuran makan untuk masyarakat umum, yaitu makanan yang seimbang dan sesuai dengan kebutuhan kalori dan zat gizi masing-masing individu. Penderita Diabetes Mellitus perlu diberikan penekanan mengenai pentingnya keteraturan kalori, terutama pada penderita yang menggunakan obat yang dapat meningkatkan sekresi insulin atau terapi insulin itu sendiri (Perkeni, 2015).

3. Latihan jasmani

Latihan jasmani dapat dilakukan secara teratur sebanyak 3-5 kali perminggu selama sekitar 30-45 menit, jeda latihan tidak lebih dari 2 hari berturut-turut. Latihan jasmani juga juga untuk

menurunkan berat badan dan memperbaiki sensitivitas insulin, sehingga akan memperbaiki kendali glukosa darah. Latihan jasmani yang dianjurkan berupa latihan jasmani dengan intensitas sedang (50-70% denyut jantung maksimal). Latihan jasmani sebaiknya disesuaikan dengan umur, dan status kesehatan jasmani (Perkeni, 2015).

4. Terapi farmakologis

Terapi farmakologis diberikan bersama dengan pengaturan makan dan latihan jasmani (gaya hidup sehat). Terapi farmakologis terdiri dari obat oral dan suntikan (Perkeni, 2015).

a. Obat antihiperglikemia oral

Berdasarkan cara kerjanya, obat antihiperglikemia oral dibagi menjadi lima golongan yaitu, pemacu sekresi insulin (*insulin secretagogue*), peningkat sensitivitas terhadap insulin, penghambat absorpsi glukosa di saluran pencernaan, penghambat DPP-IV (*Dipeptidyl Peptidase-IV*), Penghambat SGLT-2 (*Sodium Glukose Co-transporter 2*) (Perkeni, 2015).

b. Obat antihiperglikemia suntik

Termasuk anti hiperglikemia suntik, yaitu insulin, agonis GLP-1 (*Incretin Mimetic*) dan terapi kombinasi insulin (Perkeni, 2015).

2.3 Kualitas Hidup pada Diabetes Mellitus

2.3.1 Pengertian Kualitas Hidup

Kualitas hidup (*quality of life*) yaitu perasaan individu tentang kesehatan dan kesejahteraannya dalam area yang luas meliputi fungsi fisik, fungsi psikologis dan fungsi sosial (Yusra, 2010). Menurut peneliti, kualitas hidup merupakan suatu kesejahteraan yang dapat dirasakan oleh seseorang yang berasal dari kepuasan atau dari ketidakpuasan didalam kehidupan sehari-hari seseorang.

Kualitas hidup juga didefinisikan sebagai persepsi seorang individu terhadap posisi individu tersebut terhadap kehidupan yang meliputi budaya, nilai dan hubungannya terhadap tujuan hidup, harapan, standar dan perhatian. Persepsi ini merupakan konsep yang luas yang dapat mempengaruhi kesehatan fisik, keadaan psikologis, tingkat ketergantungan, hubungan sosial, keyakinan personal dan hubungannya dengan keinginan di masa yang akan datang terhadap lingkungan individu tersebut (Yusra, 2010). Kualitas hidup merupakan bagaimana individu menilai pengalaman-pengalaman hidupnya serta keseluruhan dengan pemikiran yang positif ataupun yang negative (Karangoro, 2012).

2.3.2 Domain Kualitas Hidup

Kualitas hidup memiliki empat aspek domain, yaitu :

1. Domain fisik

Domain fisik yaitu terdiri dari kenyamanan fisik dalam melakukan aktivitas sehari-hari, tenaga yang dimiliki dan kelelahan atau perasaan lelah, kesempatan untuk tidur dan istirahat, ketergantungan pada bahan-bahan medis atau pertolongan medis dan mobilitas (Sandjaya, 2018).

2. Domain psikologis

Domain psikologis yaitu terdiri dari perasaan positif dan negative, kemampuan berfikir dan belajar ketika menghadapi masalah, kemampuan dalam mengingat, kemampuan berkonsentrasi dalam mengerjakan suatu hal, harga diri, gambaran diri serta penampilan diri, spiritualitas dan kepercayaan seorang individu (Sandjaya, 2018).

3. Domain hubungan sosial

Domain hubungan sosial terdiri dari hubungan setiap individu, dukungan sosial atau sosial support, dan aktivitas seksual (Sandjaya, 2018).

4. Domain lingkungan

Domain lingkungan yaitu terdiri dari keamanan lingkungan tempat tinggal, sumber penghasilan, kesehatan, perhatian sosial, kesempatan untuk mendapatkan informasi baru dan partisipasi dalam kesempatan berkreasi (Sandjaya, 2018).

2.3.3 Faktor yang Mempengaruhi Kualitas Hidup Diabetes Mellitus

Berdasarkan hasil penelitian, faktor-faktor yang dapat mempengaruhi kualitas hidup pada penderita Diabetes Mellitus, yaitu :

1. Usia

Diabetes Mellitus tipe 2 merupakan jenis Diabetes Mellitus yang paling banyak jumlahnya yaitu sekitar 90-95% dari seluruh penderita diabetes mellitus yang lainnya dan banyak dialami oleh orang dewasa di atas 30 tahun. Pada penderita Diabetes Mellitus pada usia kurang dari 65 tahun, kualitas tidur yang baik dapat tercapai dan biasanya lebih riang, optimis dan memiliki pandangan positif tentang kehidupan (Spasic et al, 2014).

2. Jenis kelamin

Laki-laki memiliki kualitas hidup yang lebih baik dibandingkan dengan perempuan. Kehidupan sosial yang lebih baik dan aktivitas fisik berkontribusi terhadap tingkat kepuasan dalam kehidupan individu dan yang lebih berperan lebih tinggi adalah laki-laki. Laki-laki lebih percaya terkait kemampuannya untuk mengontrol diabetes dan memiliki kualitas hidup lebih tinggi serta tidak rentan terhadap depresi atau mengalami kecemasan dibandingkan dengan perempuan (Spasic et al, 2014).

3. Tingkat pendidikan

Kualitas hidup yang rendah sangat berpengaruh terhadap tingkat pendidikan yang rendah pula dan kebiasaan aktifitas fisik yang kurang baik. Tingkat pendidikan pada umumnya akan mempengaruhi kemampuan dalam menerima dan mengolah informasi (Tia, 2018)

4. Lama menderita Diabetes Mellitus

Pada penelitian Fisher (dalam Yusra, 2010), responden yang baru mmenderita Diabetes Mellitus selama 4 bulan sudah menunjukkan efikasi diri yang baik. Adanya efikasi yang baik tentunya perawatan diri pasien juga akan baik sehingga mampu mempertahankan kualitas hidup yang baik. Namun pada penelitian Bernal, Woolley, Schenzul dan Dickinson (dalam Yusra, 2010), menemukan bahwa pasien yang telah lama menderita Diabetes Mellitus dengan disertai komplikasi memiliki efikasi dari yang yang rendah. Jadi, lamanya menderita dan disertai dengan komplikasi akan mempengaruhi kualitas hidup penderit Diabetes Mellitus

5. Komplikasi Diabetes Mellitus

Komplikasi berhubungan dengan kualitas hidup yang rendah, penderita tanpa komplikasi melaporkan kualitas hidup tinggi, sedangkan dengan dua ataupun lebih komplikasi melaporkan kualitas hidup yang rendah (Andayani; Ibrahim; Asdie, 2010).

6. Tidur

Apabila tidur mengalami gangguan maka akan mempengaruhi seluruh aspek didalam diri seseorang terutama pada penderita penyakit kronik seperti diabetes mellitus yang rentan terhadap insomnia (Surani et al, 2014).

2.3.4 Pengukuran kualitas hidup

Pengukuran kualitas hidup menggunakan instrument WHOQOL-BREF yang berupa kuesioner. Kuesioner WHOQOL-BREF terdiri dari empat dimensi, yaitu dimensi fisik, psikologi, sosial, dan lingkungan dengan 26 pertanyaan yang meliputi 7 item pertanyaan dari kesehatan fisik, 6 item pertanyaan dari dimensi psikologi, 3 item pertanyaan dari dimensi sosial, dan 8 item pertanyaan dari dimensi lingkungan. Semua hasil perhitungan kualitas hidup akan ditransformasikan menjadi 0-100 sesuai dengan ketentuan dari WHOQOL-BREF, semakin tinggi skor yang didapat maka akan semakin baik kualitas hidup pasien, dan bila skor yang didapat semakin rendah maka semakin buruk kualitas hidup pasien (Latifa et al, 2019)

2.4 Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Diabetes Mellitus

Penderita diabetes mellitus umumnya mengeluhkan kesulitan untuk tidur yang disebabkan oleh gejala klinis yang dirasakan seperti polyuria yang menyebabkan nokturia, nyeri perifer, kebas dan sleep apnea (Faith, S et al, 2008). Terjadinya gangguan akan berdampak pada meningkatnya frekuensi terbangun dan sulit untuk tidur kembali yang pada akhirnya akan menyebabkan penurunan kualitas tidur (Potter & Perry, 2007).

Beberapa faktor yang dapat menyebabkan gangguan tidur pada penderita diabetes mellitus adalah faktor fisik, faktor psikologis, dan faktor lingkungan. Faktor fisik meliputi nokturia, banyak minum, banyak makan, kesemutan, dan kram pada kaki, nyeri dan ketidaknyamanan fisik. Sedangkan faktor pada psikologis meliputi depresi, kecemasan, dan stress. Faktor lingkungan meliputi keadaan rumah, ventilasi yang buruk, suhu yang terlalu panas atau terlalu dingin, dan suatu lingkungan yang baru (Potter & Perry, 2007).

Nokturia merupakan penyebab tersering pada gangguan tidur pada penderita diabetes mellitus. Nokturia merupakan suatu keadaan berkemih pada malam hari yang dapat mengganggu tidur dan siklus tidur seseorang (Zelta et al, 2015). Jika kadar gula darah diatas 160-180mg/dl, maka glukosa akan sampai ke air kemih. Tetapi jika kadar glukosa lebih tinggi dari 180mg/dl, maka ginjal akan membuang air tambahan untuk mengencerkan

sejumlah besar glukosa yang hilang. Karena ginjal menghasilkan air kemih dalam jumlah yang berlebihan sehingga penderita sering berkemih dalam jumlah yang banyak. Akibatnya penderita akan merasakan haus yang berlebihan sehingga akan banyak minum. Dengan kondisi seperti ini penderita diabetes mellitus akan sering terbangun untuk minum (Zelta et al, 2015).

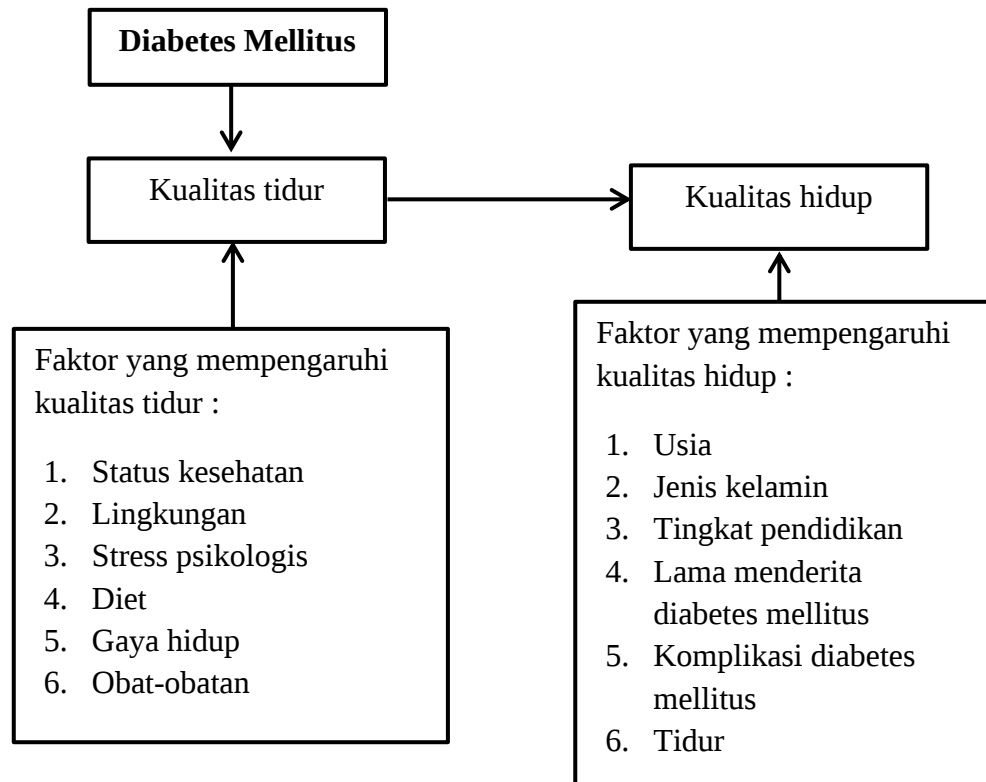
Kegagalan dalam pemenuhan kebutuhan tidur dapat memberikan efek negative pada aspek fisiologis, aspek psikologis dan aspek sosial. Efek fisiologis yang akan ditimbulkan yaitu terdapat peningkatan noradrenalin serum, peningkatan ACTH dan kortisol, juga penurunan produksi melatonin. Sedangkan efek psikologis akan menyebabkan gangguan memori, gangguan berkonsentrasi, irritable, kehilangan motivasi, depresi, dan sebagainya. Efek sosial yang akan ditimbulkan yaitu berupa kualitas hidup yang terganggu, seperti kurang menikmati hubungan sosial dan keluarga (Earnest et al, 2013).

Kurang tidur selama periode yang lama akan menyebabkan penyakit lain atau akan memperburuk suatu penyakit yang ada serta akan berdampak pada lamanya proses penyembuhan (Potter & Perry, 2007). Gangguan tidur pada penderita diabetes mellitus dapat memperburuk kondisi penyakit yang dialami dan jika ditambah dengan adanya komplikasi serta tekanan psikologis akibat dari penyakit ini akan berdampak pada kualitas hidup penderita diabetes mellitus (Pean et al, 2014).

Kualitas tidur berkorelasi positif dengan kualitas hidup yang artinya semakin baik kualitas tidur maka semakin baik pula kualitas hidup seseorang (Jenny, 2005). Berdasarkan hasil penelitian yang dilakukan oleh Yoshitaka Hashimoto, Ryosuke Sakai, Kenichiro Ikeda dan Michiaki Fukui pada tahun 2020, diketahui bahwa kualitas tidur dari 342 responden didapatkan bahwa kualitas tidur responden yang buruk sebesar 66,4% responden dengan menunjukkan gejala-gejala gangguan dalam tidur, yaitu 35,4% menunjukkan responden bangun untuk ke kamar mandi, 27,8% menunjukkan responden mengantuk pada siang hari dan 20,2% menunjukkan responden bangun yang terlalu pagi. Sedangkan, kualitas hidup dari 342 responden didapatkan bahwa kualitas hidup responden rendah karena responden bangun untuk pergi ke kamar mandi, mengantuk pada siang hari dan bangun yang terlalu pagi

Analisa hubungan kualitas tidur dengan kualitas hidup pada Diabetes Mellitus menunjukkan kualitas tidur yang buruk dengan adanya gangguan pada saat tidur akan menyebabkan kualitas hidup yang lebih rendah pada penderita Diabetes Mellitus terutama pada responden yang mengalami mengantuk pada siang hari dan bangun untuk ke kamar mandi.

2.5 Kerangka Konsep



BAB III

METODE PENELITIAN

3.1 Pengumpulan Data

3.1.1 Desain Penelitian

Penelitian ini merupakan penelitian dengan Studi Literatur. Studi literatur merupakan penelitian yang dilakukan oleh peneliti dengan mengumpulkan beberapa buku, artikel dan jurnal, yang berkaitan dengan masalah dan tujuan penelitian. Jenis penelitian yang digunakan sebagai literature adalah penelitian dengan desain studi lliteratur, Cross-sectional study dan Randomized clinical trial. Sumber data yang digunakan dalam penelitian ini menggunakan data sekunder yaitu data yang diperoleh dari hasil penelitian yang sudah dilakukan oleh peneliti-peneliti sebelumnya ataupun dari berbagai database seperti *ProQuest*, *Science Direct*, *Pubmed*, *Research Gate*, dan *google scholar*

3.2 Strategi Pencarian Literature

3.2.1 Framework yang digunakan

Strategi yang digunakan untuk mencari artikel menggunakan PICOS framework.

1. *Population/problem*, populasi atau masalah yang akan di analisis

2. *Intervention*, suatu tindakan penatalaksanaan terhadap kasus perorangan atau masyarakat serta pemaparan tentang penatalaksanaan
3. *Comparation*, penatalaksanaan lain yang digunakan sebagai pembandingan
4. *Outcome*, hasil atau luaran yang diperoleh pada penelitian
5. *Study design*, desain penelitian yang digunakan oleh jurnal yang akan di review

3.2.2 Database Pencarian

Data yang digunakan dalam penelitian ini menggunakan data sekunder yaitu, data yang diperoleh bukan dari pengamatan secara langsung, akan tetapi diperoleh dari hasil penelitian yang sudah dilakukan oleh peneliti-peneliti sebelumnya. Sumber data sekunder yang didapat berupa artikel jurnal yang relevan dengan topik dilakukan menggunakan database melalui *ProQuest*, *Science Direct*, *Pubmed*, *Research Gate*, dan *google scholar*

3.2.3 Kata Kunci

Pencarian artikel atau jurnal menggunakan *keyword* dan *Boolean operator* (AND, OR NOT or AND NOT) yang digunakan untuk memperluas atau menspesifikasikan pencarian, sehingga mempermudah

dalam pencarian artikel atau jurnal yang digunakan. Kata kunci yang digunakan dalam penelitian ini yaitu, “*sleep quality*” AND “*quality of life*” AND “*diabetes mellitus*”.

3.3 Kriteria Inklusi dan Eksklusi

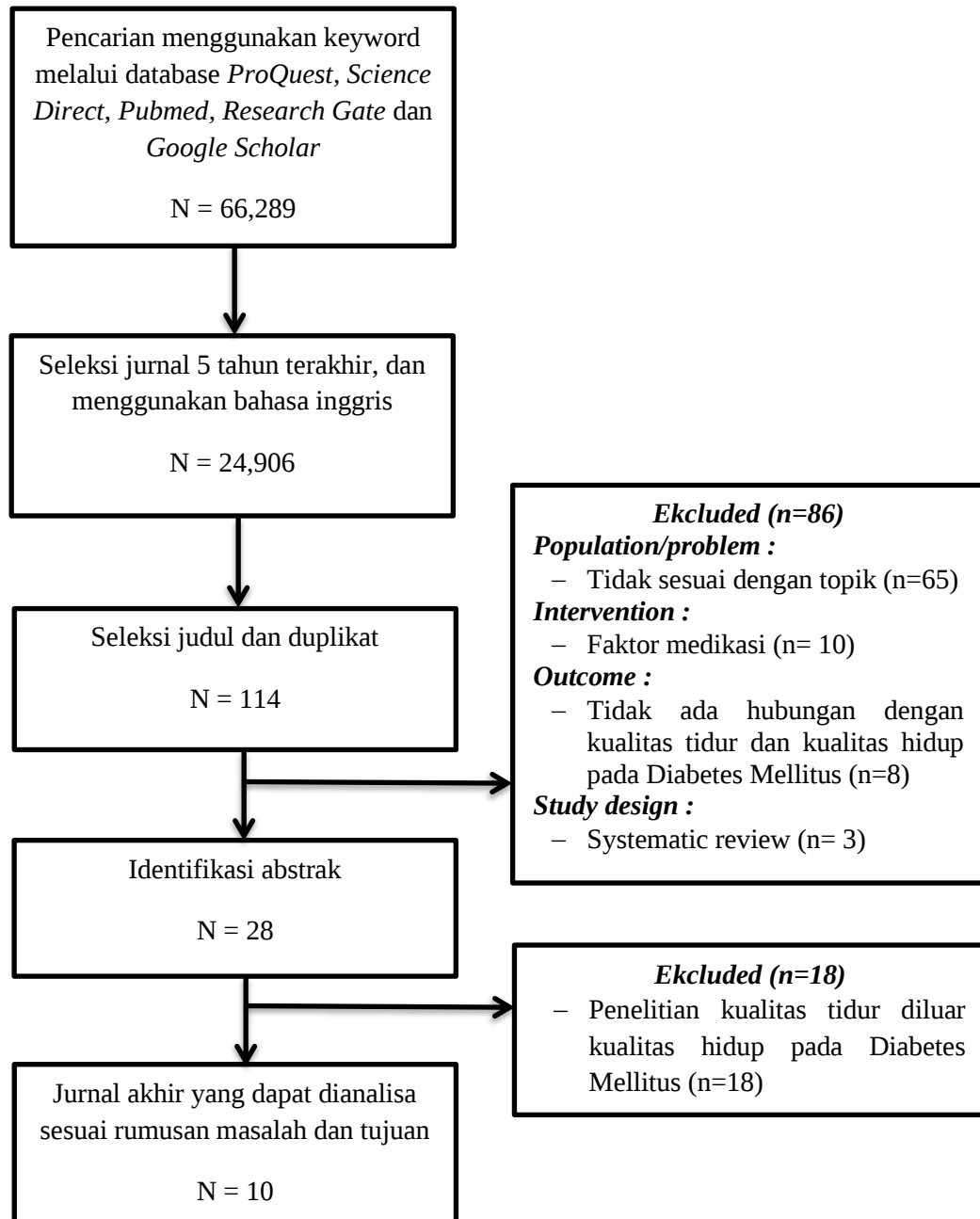
Tabel 3.1 Kriteria inklusi dan eksklusi dengan menggunakan format PICOS

Kriteria	Inklusi	Eksklusi
<i>Population / problem</i>	Jurnal internasional dan terakreditasi sinta yang berhubungan dengan topik penelitian yaitu kualitas tidur dengan kualitas hidup pada Diabetes Mellitus	Jurnal internasional dan terakreditasi sinta yang tidak berhubungan dengan topik penelitian yaitu kualitas tidur dengan kualitas hidup pada Diabetes Mellitus
<i>Intervention</i>	Faktor yang dapat menurunkan kualitas tidur dengan kualitas hidup pada Diabetes Mellitus antara lain : kecemasan, depresi, gangguan tidur, RLS (Restless Legs Syndrome), dan nyeri neuropatik	Faktor yang tidak dapat menurunkan kualitas tidur dengan kualitas hidup pada Diabetes Mellitus
<i>Comparison</i>	Membandingkan kualitas tidur dengan kualitas hidup DM	Tidak membandingkan kualitas tidur dengan kualitas hidup DM
<i>Outcome</i>	Kualitas tidur dapat menurunkan kualitas hidup pada penderita Diabetes Mellitus	Kualitas tidur tidak dapat menurunkan kualitas hidup pada penderita Diabetes Mellitus
<i>Study design</i>	Cross-sectional study	<i>Literature review</i>
<i>Tahun terbit</i>	Artikel atau jurnal yang terbit setelah tahun 2016	Artikel atau jurnal yang terbit sebelum tahun 2016
<i>Bahasa</i>	Bahasa inggris dan bahasa Indonesia	Selain bahasa inggris dan bahasa Indonesia

3.4 Seleksi Studi dan Pencarian

3.4.1 Hasil Pencarian dan Seleksi Studi

Dari hasil pendarian literature review melalui database *ProQuest*, *Science Direct*, *Pubmed*, *Research Gate*, dan *google scholar* dengan menggunakan keyword “*sleep quality*” AND “*quality of life*” AND “*diabetes mellitus*”, dalam pencarian peneliti menemukan 66,289 jurnal dan kemudian diseleksi hingga mendapatkan 24,906 jurnal dengan jurnal dibawah tahun 2016. Selanjutnya diseleksi kembali sesuai dengan topik yang diteliti dan jurnal duplikasi sehingga mendapatkan 114 jurnal. Kemudian didapatkan adanya ketidaklayakan kriteria inklusi sehingga didapatkan 10 jurnal yang akan dilakukan review



Gambar 3.1 Diagram alur review jurnal

3.4.2 Daftar Artikel Hasil Pencarian

Literature review ini disintesis menggunakan metode naratif dengan mengelompokkan data-data hasil ekstraksi yang sejenis dengan hasil yang diukur untuk menjawab tujuan. Jurnal penelitian yang sesuai dengan kriteria inklusi kemudian dikumpulkan dan dibuat ringkasan jurnal yang meliputi nama peneliti, tahun terbit, judul penelitian, metode yang digunakan pada penelitian dan database.

Tabel 3.2 Daftar artikel hasil pencarian

No	Author	Tahun	Volume angka	Judul	Metode (Desain, Sampel, Variabel, Instrumen, Analisis)	Hasil Penelitian
1.	Dong Dong , Peian Lou, Jian Wang , Pan Zhang , Jianquan Sun , Guiqiu Chang and Chunrong Xu	2020	Vol 18	Interaction of sleep quality and anxiety on quality of life in individuals with type 2 diabetes mellitus	D : Cross-sectional study S : V : Kualitas tidur, Kecemasan dan depresi, kualitas hidup I : Pittsburgh Sleep Quality Index (PSQI), Patient Health Questionnaire-9 (PHQ-9), General Anxiety Disorder (GAD-7), Skala Kualitas Hidup Spesifisitas Diabetes (DSQL) A : t-tests, pearson chi-square test, binary logistic regression, pearson Correlation	Hasil dari penelitian menyebutkan bahwa responden mengalami kualitas tidur yang buruk karena memiliki gejala kecemasan dan depresi sehingga berpengaruh terhadap penurunan kualitas hidup pada penderita diabetes mellitus tipe 2.
2	Yoshitaka Hashimoto, Ryosuke Sakai, Kenichiro Ikeda and Michiaki Fukui	2020	Vol 20	Association between sleep disorder and quality of life in patients with type 2 diabetes: a cross-sectional study	D : Cross-sectional study S : Random sampling V : Gangguan tidur, kualitas hidup I : Survei format pendek 36-Item (SF36v2) dan EuroQol 5 Dimensi (EQ-5D) A : T-test and one-way ANOVA test, Chi-square test	Hasil dari penelitian menyebutkan bahwa gangguan tidur seperti bangun untuk ke kamar mandi, mengantuk pada siang hari dan bangun terlalu pagi dapat menurunkan kualitas hidup dan gangguan aktivitas secara keseluruhan pada penderita diabetes mellitus tipe 2

3.	Wegdan Bani-issa PhD, RN, Arwa M Al-Shujairi, MPH, Linda Patrick, RN, MA, MSc, PhD	2017	Vol 27	Association Between Quality of Sleep and Health-Related Quality of Life in Persons With Diabetes Mellitus Type 2	D : Cross-sectional study S : Cluster sampling V : Kualitas tidur, kualitas hidup I : Pittsburgh Sleep Quality Index (PSQI), WHOQOL-BREF A : t-test, Chi-squared test, logistic regression analysis	Hasil dari penelitian menyebutkan bahwa responden dengan kualitas tidur yang buruk yang disebabkan oleh adanya disfungsi pada siang hari dan berpengaruh terhadap kualitas hidup penderita diabetes mellitus
4.	Md Azharuddin, Prem Kapur, Mohammad Adil, Pinaki Ghosh, Manju Sharma	2020	Vol 73	Health-related quality of life and sleep quality among North Indian type 2 diabetes mellitus patients: evidence from a cross- sectional study	D : Cross-sectional study S : Total sampling V : Kualitas tidur, kualitas hidup I : Pittsburgh Sleep Quality Index (PSQI) dan European Quality of Life-5 Dimensions Questionnaire (EQ-5D) A : . Student's t-test, chi square (χ^2) test, AVONA test, Spearman's rank correlation coefficients, Logistic regression models, Bivariate logistic regression analysis	Hasil dari penelitian menyebutkan bahwa gangguan tidur seperti latensi tidur dan nyeri atau rasa yang tidak nyaman dapat menurunkan kualitas hidup pada penderita diabetes mellitus tipe 2
5.	Mustafa Demir	2019	Vol 26	Quality of life and sleep in diabetes mellitus patients	D : Prospective cross-sectional study S : V : Kualitas tidur, kualitas hidup I : SF-36 dan PSQ A : Chi-square test, Student's t test, Pearson correlation test	Hasil dari penelitian menyebutkan bahwa kualitas tidur yang buruk dipengaruhi oleh adanya gangguan tidur yang dialami oleh responden dan menyebabkan kualitas tidur yang buruk sehingga berpengaruh terhadap kualitas hidup yang terganggu.

6.	Leila Modarresnia, MD, Fatemeh Golgiri, MD, Nahid Hashemi Madani, Zahra Emami, PhD, Kiarash Tanha, MSc	2018	Vol 14 No.2	Restless Legs Syndrome in Iranian People With Type 2 Diabetes Mellitus: The Role in Quality of Life and Quality of Sleep	D : Cross-sectional study S : Convenience sampling V : Kualitas tidur, kualitas hidup I : Pittsburgh Sleep Quality Index dan EuroQo (EQ-5D-3L) A : Mann-Whitney U test, Kruskal-Wallis test, and χ^2 test, Spearman correlation coefficient, , binary logistic regression model, linear regression analysis	Hasil dari penelitian menyebutkan bahwa kualitas tidur yang buruk dipengaruhi oleh RLS (Restless Legs Syndrome), yaitu sensasi yang tidak nyaman pada kaki dan biasanya akan memburuk pada malam hari sehingga tidur akan terganggu akibat rasa tidak nyaman pada kaki sehingga memiliki kualitas hidup yang lebih rendah atau buruk
7.	Rodrigo S. Delevatti, Felipe Barreto Schuch, Ana Carolina Kanitz, Cristine L. Alberton, Elisa Corrêa Marson, Salime Chedid Lisboa, Carolina Dertzbocher Feil Pinho, Luciana Peruchena Bregagnol, Maríndia Teixeira Becker, Luiz Fernando M. Kruehl	2017	Vol 21	Quality of life and sleep quality are similarly improved after aquatic or dry-land aerobic training in patients with type 2 diabetes: A randomized clinical trial	D : Randomized clinical trial S : Purposive sampling V : Kualitas tidur, kualitas hidup, gejala depresi I : WHOQOL-BREF, Pittsburgh Sleep Quality Index (PSQI), Beck Depression Inventory (BDI) A : Student's t-test, Mann-Whitney	Hasil dari penelitian menyebutkan bahwa gejala depresi dan kualitas tidur yang buruk seperti keluhan tidur bisa mempengaruhi kualitas hidup secara keseluruhan. Pada latihan aerobik ini responden melakukan latihan fisik sehingga dapat menurunkan hormone stress dan meningkatkan hormone endorphen sehingga tubuh menjadi lebih baik dan kualitas hidup meningkat pada domain fisik dan emosional serta keluhan tidur yang menurun.

8.	Berthiana, Wijaya Atmaja Kasuma	2020	Vol 12 No. 1	Hubungan Kualitas Tidur Dengan Kualitas Hidup Lansia Dengan Penyakit Diabetes Mellitus Tipe 2	D : Cross Sectional S : total sampling V : Kualitas tidur, kualitas hidup I : WHOQOL-BREF WHO dan Pittsburgh Sleep Quality Index (PSQI) A : uji Chi Square	Hasil dari penelitian menyebutkan bahwa kualitas tidur yang buruk seperti sulit untuk memulai tidur, merasakan panas dimalam hari, merasakan peningkatan rasa haus sehingga sering terbangun di malam hari dapat menyebabkan kualitas hidup yang buruk pada penderita diabetes mellitus
9.	Akhmadi	2019		Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Lansia Dengan Penyakit Diabetes Mellitus Tipe 2 Di Klub Prolanis Sanang Barigas Palangka Raya	D : Cross Sectional S : Point time approach V : Kualitas tidur, kualitas hidup I : A : uji Chi Square	Hasil dari penelitian menyebutkan bahwa kualitas tidur yang buruk seperti sulit untuk memulai tidur, merasakan panas dimalam hari, sering terbangun di malam hari dapat menyebabkan kualitas hidup yang buruk pada penderita diabetes mellitus
10.	Yanbing Zeng, Jielong Wu, Jiahui Yin, Jia Chen, Shu]Yu Yag, Ya Fang	2018		Association Of The Combination Of Sleep Duration And Sleep Quality With Quality Of Life In Type 2 Diabetes Mellitus	D : Cross-sectional study S : V : Durasi tidur, kualitas tidur, kualitas hidup I : Diabetes Specific Quality Of Life (DSQL) A : Chi-squared tests	Hasil dari penelitian menyebutkan bahwa durasi tidur yang berlebihan (≥ 9 jam per hari) akan berdampak pada menurunnya kualitas hidup penderita diabetes mellitus tipe 2.

BAB IV

HASIL DAN ANALISIS

4.1 Karakter Studi

Tabel 4.1 karakteristik studi berdasarkan *literature review*

No	Penulis	Tahun/ volume	Judul	Metode (Desain, Sampel, Variabel, Instrumen, Analisis)
1.	Dong Dong , Peian Lou, Jian Wang , Pan Zhang , Jianquan Sun , Guiqiu Chang and Chunrong Xu	2020 Vol 18	Interaction of sleep quality and anxiety on quality of life in individuals with type 2 diabetes mellitus	D : Cross-sectional study S : V : Kualitas tidur, Kecemasan dan depresi, kualitas hidup I : Pittsburgh Sleep Quality Index (PSQI), Patient Health Questionnaire-9 (PHQ-9), General Anxiety Disorder (GAD-7), Skala Kualitas Hidup Spesifisitas Diabetes (DSQL) A : t-tests, pearson chi-square test
2.	Yoshitaka Hashimoto, Ryosuke Sakai, Kenichiro Ikeda and Michiaki Fukui	2017 Vol 27	Association Between Quality of Sleep and Health-Related Quality of Life in Persons With Diabetes Mellitus Type 2	D : Cross-sectional study S : Random sampling V : Gangguan tidur, kualitas hidup I : Survei format pendek 36-Item (SF36v2) dan EuroQol 5 Dimensi (EQ-5D) A : T-test and one-way ANOVA test, Chi-square test
3.	Wegdan Bani- issa PhD, RN, Arwa M Al- Shujairi, MPH, Linda Patrick, RN, MA, MSc, PhD	2017 Vol 27	Association Between Quality of Sleep and Health-Related Quality of Life in Persons With Diabetes Mellitus Type 2	D : Cross-sectional study S : Cluster sampling V : Kualitas tidur tidur, kualitas hidup I : Pittsburgh Sleep Quality Index (PSQI), WHOQOL-BREF A : t-test, Chi-squared test

4.	Md Azharuddin, Prem Kapur, Mohammad Adil, Pinaki Ghosh, Manju Sharma	2020 Vol 73	Health-related quality of life and sleep quality among North Indian type 2 diabetes mellitus patients: evidence from a cross-sectional study	D : Cross-sectional study S : Total sampling V : Kualitas tidur, kualitas hidup I : Pittsburgh Sleep Quality Index (PSQI) dan European Quality of Life-5 Dimensions Questionnaire (EQ-5D) A : . Student's t-test, chi square (x2) test
5.	Mustafa Demir	2019 Vol 26	Quality of life and sleep in diabetes mellitus patients	D : Cross-sectional study S : V : Kualitas tidur, kualitas hidup I : SF-36 dan PSQ A : Chi-square test, Student's t test
6.	Leila Modarresnia, MD, Fatemeh Golgiri, MD, Nahid Hashemi Madani, Zahra Emami, PhD, Kiarash Tanha, MSc	2018 Vol 14 No.2	Restless Legs Syndrome in Iranian People With Type 2 Diabetes Mellitus: The Role in Quality of Life and Quality of Sleep	D : Cross-sectional study S : Convenience sampling V : Kualitas tidur, kualitas hidup I : Pittsburgh Sleep Quality Index dan EuroQo (EQ-5D-3L) A : Mann-Whitney U test, Kruskal-Wallis test, and χ^2 test
7.	Rodrigo S. Delevatti, Felipe Barreto Schuch, Ana Carolina Kanitz, Cristine L. Alberton, Elisa Corrêa Marson, Salime Chedid Lisboa, Carolina Dertzbocher Feil Pinho, Luciana Peruchena	2017 Vol 21	Quality of life and sleep quality are similarly improved after aquatic or dry-land aerobic training in patients with type 2 diabetes: A randomized clinical trial	D : Randomized clinical trial S : Purposive sampling V : Kualitas tidur, kualitas hidup, gejala depresi I : WHOQOL-BREF, Pittsburgh Sleep Quality Index (PSQI), Beck Depression Inventory (BDI) A : Student's t-test, Mann-Whitney
8.	Berthiana, Wijaya Atmaja Kasuma	2020 Vol 12 No. 1	Hubungan Kualitas Tidur Dengan Kualitas Hidup Lansia Dengan Penyakit Diabetes Mellitus Tipe 2	D : Cross Sectional S : total sampling V : Kualitas tidur, kualitas hidup I : WHOQOL-BREF WHO dan Pittsburgh Sleep Quality Index (PSQI) A : uji Chi Square

9.	Akhmadi	2019	Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Lansia Dengan Penyakit Diabetes Mellitus Tipe 2 Di Klub Prolanis Sanang Barigas Palangka Raya	D : Cross Sectional S : Point time approach V : Kualitas tidur, kualitas hidup I : A : uji Chi Square
10.	Yanbing Zeng, Jielong Wu, Jiahui Yin, Jia Chen, Shu]Yu Yag, Ya Fang	2018	Association Of The Combination Of Sleep Duration And Sleep Quality With Quality Of Life In Type 2 Diabetes Mellitus	D : Cross-sectional study S : V : Durasi tidur, kualitas tidur, kualitas hidup I : Diabetes Specific Quality Of Life (DSQL) A : Chi-squared tests

Hasil penelusuran jurnal dan artikel pada penelitian berdasarkan topik “Analisa Hubungan Kualitas Tidur Dengan Kualitas Hidup pada Diabetes Mellitus berdasarkan studi literatur” didapatkan 10 jurnal penelitian dimana seluruhnya berjenis kuantitatif dengan desain penelitian adalah menggunakan statistik deskriptif dengan pendekatan studi *cross-sectional* dan Randomized clinical trial. Secara keseluruhan penelitian membahas tentang Hubungan Kualitas Tidur Dengan Kualitas Hidup pada Diabetes Mellitus. Dari 10 artikel jurnal yang digunakan pada literatur review ini berjenis kuantitatif, dan rentang tahun artikel jurnal yang diambil yaitu tahun 2017-2020.

4.2 Karakteristik Responden

Tabel 4.2 Karakteristik Responden berdasarkan *literature review*

No	Penulis	Tahun	Judul	Karakteristik Responden			
				Umur	Jenis kelamin	Pendidikan	Durasi diabetes mellitus
1.	Dong Dong , Peian Lou, Jian Wang , Pan Zhang , Jianquan Sun , Guiqiu Chang and Chunrong Xu	2020	Interaction of sleep quality and anxiety on quality of life in individuals with type 2 diabetes mellitus	27 - 97 tahun dengan jumlah responden = 997	Perempuan 61,3%, Laki-laki 38,7%	Perguruan tinggi 87, Lainnya (SD, SMP, SMA) 910 responden	Lebih dari 1 tahun sejak terdiagnosa diabetes mellitus
2.	Yoshitaka Hashimoto, Ryosuke Sakai, Kenichiro Ikeda and Michiaki Fukui	2020	Association between sleep disorder and quality of life in patients with type 2 diabetes: a cross-sectional study	18 tahun atau lebih dengan jumlah responden = 342	Laki-laki 82,5%, Perempuan 17,5%	Gelar sarjana 46,5%, Lainnya (SD, SMP, SMA) 53,5%	Lebih dari 2 tahun sejak terdiagnosa diabetes mellitus
3.	Wegdan Bani-issa PhD, RN, Arwa M Al-Shujairi, MPH, Linda Patrick, RN, MA, MSc, PhD	2017	Association Between Quality of Sleep and Health-Related Quality of Life in Persons With Diabetes Mellitus Type 2	20 - 60 tahun dengan jumlah responden = 268	Laki-laki 38,0%, Perempuan 61,9%	Tidak berpendidikan 14,6%, SD 13,4%, SMP 13,8%, SMA 29,9%, Gelar sarjana 28,4%	Lebih dari 0 – lebih 11 tahun sejak terdiagnosa diabetes mellitus

4.	Md Azharuddin, Prem Kapur, Mohammad Adil, Pinaki Ghosh, Manju Sharma	2020	Health-related quality of life and sleep quality among North Indian type 2 diabetes mellitus patients: evidence from a cross-sectional study	18 tahun atau lebih dengan jumlah responden = 300	Laki-laki 50,7%, Perempuan 49,3%	Gelar kehormatan 1,0%, Pasca sarjana 12,3%, Menengah 16,0%, SMA 16,3%, SMP 3,7%, SD 16,3%, Terpelajar 25,3% Buta huruf 9,0%.	Lebih dari 1 tahun sejak terdiagnosa diabetes mellitus
5.	Mustafa Demir	2019	Quality of life and sleep in diabetes mellitus patients	18 tahun atau lebih dengan jumlah responden = 200	Laki-laki 45,5%, Perempuan 54,5%	gelar sarjana 38, SMA 54, SMP 46, SD 57 Buta huruf 5	Tidak dijelaskan berapa lama durasi diabetes mellitus
6.	Leila Modarresnia, MD, Fatemeh Golgiri, MD, Nahid Hashemi Madani, Zahra Emami, PhD, Kiarash Tanha, MSc	2018	Restless Legs Syndrome in Iranian People With Type 2 Diabetes Mellitus: The Role in Quality of Life and Quality of Sleep	Dibawah 30 tahun atau lebih dari 70 tahun dengan jumlah responden = 210	Laki-laki 39,5%, Perempuan 60,5%	Tidak dijelaskan karakteristik menurut pendidikan	Lebih dari 1 tahun sejak terdiagnosa diabetes mellitus

7.	Rodrigo S. Delevatti, Felipe Barreto Schuch, Ana Carolina Kanitz, Cristine L. Alberton, Elisa Corrêa Marson, Salime Chedid Lisboa, Carolina Dertzbocher Feil Pinho, Luciana Peruchena Bregagnol, Maríndia Teixeira Becker, Luiz Fernando M. Kruel	2017	Quality of life and sleep quality are similarly improved after aquatic or dry-land aerobic training in patients with type 2 diabetes: A randomized clinical trial	30 tahun atau lebih dengan jumlah responden = 35	Laki-laki 15, Perempuan 20	Tidak dijelaskan karakteristik menurut pendidikan	Lebih dari 1 tahun sejak terdiagnosa diabetes mellitus
8.	Berthiana, Wijaya Atmaja Kasuma	2020	Hubungan Kualitas Tidur Dengan Kualitas Hidup Lansia Dengan Penyakit Diabetes Mellitus Tipe 2	60 tahun ke atas dengan jumlah responden = 33	Laki-laki 20, Perempuan 13	SMP 18,2%, SMA 45,5%, S1/S2 36,4%	Tidak dijelaskan berapa lama durasi diabetes mellitus
9.	Akhmadi	2019	Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Lansia Dengan Penyakit Diabetes Mellitus Tipe 2 Di Klub Prolanis Sanang Barigas Palangka Raya	60 - 74 tahun dengan jumlah responden = 33	Laki-laki 60,6%, Perempuan 39,4%	SMP 18,2%, SMA 45,5%, S1/S2 36,4%	Tidak dijelaskan berapa lama durasi diabetes mellitus

10.	Yanbing Zeng, Jielong Wu, Jiahui Yin, Jia Chen, Shu]Yu Yag, Ya Fang	2018	Association Of The Combination Of Sleep Duration And Sleep Quality With Quality Of Life In Type 2 Diabetes Mellitus	18 tahun atau lebih dengan jumlah responden = 798	Laki-laki 444, Perempuan 354	Primer 281, Sekunder 384, Tersier 133	Kurang dari 5 - 10 tahun sejak terdiagnosa diabetes mellitus
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Berdasarkan tabel 4.2 menunjukkan karakteristik responden berdasarkan umur dari kesepuluh jurnal diatas didapatkan rata-rata usia penderita diabetes mellitus adalah umur 18 tahun atau lebih. Karakteristik responden berdasarkan jenis kelamin pada penderita diabetes mellitus diperoleh sebagian besar responden berjenis kelamin laki-laki. Karakteristik responden berdasarkan pendidikan diperoleh sebagian besar penderita diabetes mellitus berpendidikan SMP, SMA dan gelar sarjana. Karakteristik responden berdasarkan durasi diabetes mellitus diperoleh sebagian besar penderita diabetes mellitus memiliki durasi lebih dari 1 tahun sejak terdiagnosa diabetes mellitus.

4.3 Kualitas Tidur Pada Penderita Diabetes Mellitus

Tabel 4.3 Diskripsi kualitas tidur pada penderita diabetes mellitus berdasarkan *literature review*

No	Penulis	Tahun	Judul	Hasil	
					n
1.	Dong Dong , Peian Lou, Jian Wang , Pan Zhang , Jianquan Sun , Guiqiu Chang and Chunrong Xu	2020	Interaction of sleep quality and anxiety on quality of life in individuals with type 2 diabetes mellitus	a. Kualitas tidur baik 66,4% b. Kualitas tidur buruk 33,6%	997
2.	Yoshitaka Hashimoto, Ryosuke Sakai, Kenichiro Ikeda and Michiaki Fukui	2020	Association between sleep disorder and quality of life in patients with type 2 diabetes: a cross-sectional study	a. Kualitas tidur buruk dengan gangguan tidur = 227 responden b. Kualitas tidur baik tanpa gangguan tidur = 115 responden	342
3.	Wegdan Bani-issa PhD, RN, Arwa M Al-Shujairi, MPH, Linda Patrick, RN, MA, MSc, PhD	2017	Association Between Quality of Sleep and Health-Related Quality of Life in Persons With Diabetes Mellitus Type 2	a. Kualitas tidur buruk = 90 responden b. Kualitas tidur baik = 178 responden	268
4.	Md Azharuddin, Prem Kapur, Mohammad Adil, Pinaki Ghosh, Manju Sharma	2020	Health-related quality of life and sleep quality among North Indian type 2 diabetes mellitus patients: evidence from a cross-sectional study	a. Kualitas tidur buruk = 166 responden b. Kualitas tidur baik = 134 responden	300
5.	Mustafa Demir	2019	Quality of life and sleep in diabetes mellitus patients	Skor kualitas tidur 9,14 yang berarti kualitas tidur buruk (skor PSQI >5 = kualitas tidur buruk)	200

6.	Leila Modarresnia, MD, Fatemeh Golgiri, MD, Nahid Hashemi Madani, Zahra Emami, PhD, Kiarash Tanha, MSc	2018	Restless Legs Syndrome in Iranian People With Type 2 Diabetes Mellitus: The Role in Quality of Life and Quality of Sleep	a. Kualitas tidur buruk = 80 responden b. Kualitas tidur baik = 130 responden	210
7.	Rodrigo S. Delevatti, Felipe Barreto Schuch, Ana Carolina Kanitz, Cristine L. Alberton, Elisa Corrêa Marson, Salime Chedid Lisboa, Carolina Dertzbocher Feil Pinho, Luciana Peruchena Bregagnol, Maríndia Teixeira Becker, Luiz Fernando M. Kruel	2017	Quality of life and sleep quality are similarly improved after aquatic or dry-land aerobic training in patients with type 2 diabetes: A randomized clinical trial	a. Kualitas tidur yang baik setelah dilakukan latihan aerobik akuatik 6,7 b. Kualitas tidur yang baik setelah dilakukan latihan aerobik lahan kering 8,6	35
8.	Berthiana, Wijaya Atmaja Kasuma	2020	Hubungan Kualitas Tidur Dengan Kualitas Hidup Lansia Dengan Penyakit Diabetes Mellitus Tipe 2	a. Kualitas tidur buruk = 19 responden b. Kualitas tidur sedang = 6 responden c. Kualitas tidur baik = 8 responden	33
9.	Akhmadi	2019	Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Lansia Dengan Penyakit Diabetes Mellitus Tipe 2 Di Klub Prolanis Sanang Barigas Palangka Raya	a. Kualitas tidur baik = 8 responden b. Kualitas tidur sedang = 6 responden c. Kualitas tidur buruk = 19 responden	33

10.	Yanbing Zeng, Jielong Wu, Jiahui Yin, Jia Chen, Shu]Yu Yag, Ya Fang	2018	Association Of The Combination Of Sleep Duration And Sleep Quality With Quality Of Life In Type 2 Diabetes Mellitus	a. Kualitas tidur buruk = 209 responden b. Kualitas tidur sedang = 274 responden c. Kualitas tidur baik = 315 responden	798
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Berdasarkan tabel 4.3 menunjukkan kualitas tidur pada diabetes mellitus sebanyak 10 artikel yang telah diidentifikasi oleh peneliti hasilnya yaitu 5 artikel memiliki kualitas tidur yang buruk pada penderita diabetes mellitus dan 5 artikel lainnya memiliki kualitas tidur sedang dan kualitas tidur yang baik pada penderita diabetes mellitus.

4.4 Kualitas Hidup Pada Penderita Diabetes Mellitus

Tabel 4.4 Deskripsi kualitas hidup pada penderita diabetes mellitus berdasarkan *literature review*

No	Penulis	Tahun	Judul	Hasil
1.	Dong Dong , Peian Lou, Jian Wang , Pan Zhang , Jianquan Sun , Guiqiu Chang and Chunrong Xu	2020	Interaction of sleep quality and anxiety on quality of life in individuals with type 2 diabetes mellitus	a. kualitas hidup baik = 198 b. kualitas hidup yang buruk = 799
2.	Yoshitaka Hashimoto, Ryosuke Sakai, Kenichiro Ikeda and Michiaki Fukui	2020	Association between sleep disorder and quality of life in patients with type 2 diabetes: a cross-sectional study	Kualitas hidup yang buruk 66,4%
3.	Wegdan Bani-issa PhD, RN, Arwa M Al-Shujairi, MPH, Linda Patrick, RN, MA, MSc, PhD	2017	Association Between Quality of Sleep and Health-Related Quality of Life in Persons With Diabetes Mellitus Type 2	a. kualitas hidup baik = 121 responden b. kualitas hidup yang buruk = 147 responden
4.	Md Azharuddin, Prem Kapur, Mohammad Adil, Pinaki Ghosh, Manju Sharma	2020	Health-related quality of life and sleep quality among North Indian type 2 diabetes mellitus patients: evidence from a cross-sectional study	Hasil penelitian ini menunjukkan skor indeks EQ-5D 0,79 yang berarti kualitas hidup yang buruk.
5.	Mustafa Demir	2019	Quality of life and sleep in diabetes mellitus patients	Hasil penelitian ini menunjukkan skor QOL 0,036 yang berarti memiliki kualitas hidup yang buruk

6.	Leila Modarresnia, MD, Fatemeh Golgiri, MD, Nahid Hashemi Madani, Zahra Emami, PhD, Kiarash Tanha, MSc	2018	Restless Legs Syndrome in Iranian People With Type 2 Diabetes Mellitus: The Role in Quality of Life and Quality of Sleep	Hasil penelitian ini menunjukkan skor QOL 0,82 yang berarti bahwa kualitas hidup yang buruk
7.	Rodrigo S. Delevatti, Felipe Barreto Schuch, Ana Carolina Kanitz, Cristine L. Alberton, Elisa Corrêa Marson, Salime Chedid Lisboa, Carolina Dertzbocher Feil Pinho, Luciana Peruchena Bregagnol, Maríndia Teixeira Becker, Luiz Fernando M. Kruel	2017	Quality of life and sleep quality are similarly improved after aquatic or dry-land aerobic training in patients with type 2 diabetes: A randomized clinical trial	Hasil penelitian ini menunjukkan bahwa kualitas hidup yang meningkat setelah latihan aerobik akuatik dan aerobik lahan kering
8.	Berthiana, Wijaya Atmaja Kasuma	2020	Hubungan Kualitas Tidur Dengan Kualitas Hidup Lansia Dengan Penyakit Diabetes Mellitus Tipe 2	a. Kualitas hidup yang baik 42,4% (14 responden) b. Kualitas hidup yang buruk 57,6% (19 responden)
9.	Akhmadi	2019	Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Lansia Dengan Penyakit Diabetes Mellitus Tipe 2 Di Klub Prolanis Sanang Barigas Palangka Raya	a. Kualitas hidup yang buruk 19 responden b. kualitas hidup yang baik 14 responden
10.	Yanbing Zeng, Jielong Wu, Jiahui Yin, Jia Chen, Shu]Yu Yag, Ya Fang	2018	Association Of The Combination Of Sleep Duration And Sleep Quality With Quality Of Life In Type 2 Diabetes Mellitus	a. Kualitas hidup yang buruk 87,97% b. kualitas hidup yang baik 12,03%

Berdasarkan tabel 4.4 menunjukkan kualitas hidup pada diabetes mellitus sebanyak 10 artikel yang telah diidentifikasi oleh peneliti hasilnya yaitu lebih dari 50% memiliki kualitas hidup yang buruk yaitu terdapat 9 artikel yang menjelaskan kualitas hidup yang buruk, selebihnya 1 artikel memiliki kualitas hidup yang baik pada penderita diabetes mellitus.

4.5 Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Penderita Diabetes Mellitus

Tabel 4.5 Diskripsi hubungan kualitas tidur dengan kualitas hidup pada penderita diabetes mellitus berdasarkan *literature review*

No	Penulis	Tahun	Judul	p-value	Hasil
1.	Dong Dong , Peian Lou, Jian Wang , Pan Zhang , Jianquan Sun , Guiqiu Chang and Chunrong Xu	2020	Interaction of sleep quality and anxiety on quality of life in individuals with type 2 diabetes mellitus	$p < 0,001$	Hasil penelitan ini ada interaksi yang signifikan antara kualitas tidur yang buruk dan gejala kecemasan ini secara signifikan mengurangi skor kualitas hidup responden.
2.	Yoshitaka Hashimoto, Ryosuke Sakai, Kenichiro Ikeda and Michiaki Fukui	2020	Association between sleep disorder and quality of life in patients with type 2 diabetes: a cross-sectional study	$p < 0,001$	Hasil penelitan ini menunjukkan gangguan tidur seperti bangun untuk ke kamar mandi, mengantuk pada siang hari dan bangun yang terlalu pagi, menunjukkan secara signifikan kualitas hidup yang buruk dan gangguan aktivitas secara keseluruhan pada penderita diabetes mellitus.

3.	Wegdan Bani-issa PhD, RN, Arwa M Al-Shujairi, MPH, Linda Patrick, RN, MA, MSc, PhD	2017	Association Between Quality of Sleep and Health-Related Quality of Life in Persons With Diabetes Mellitus Type 2	$p < 0,05$	Hasil penelitian ini kualitas tidur yang buruk lebih cenderung menunjukkan hubungan yang signifikan dengan kualitas hidup yang buruk..
4.	Md Azharuddin, Prem Kapur, Mohammad Adil, Pinaki Ghosh, Manju Sharma	2020	Health-related quality of life and sleep quality among North Indian type 2 diabetes mellitus patients: evidence from a cross-sectional study	$p < 0,05$	Hasil penelitian ini menunjukkan tidur yang buruk memiliki signifikan dapat menurunkan kualitas hidup secara konstan.
5.	Mustafa Demir	2019	Quality of life and sleep in diabetes mellitus patients	$p < 0,05$	Hasil penelitian ini menunjukkan kualitas tidur yang buruk dipengaruhi oleh adanya gangguan tidur sehingga berpengaruh terhadap kualitas hidup yang terganggu.
6.	Leila Modarresnia, MD, Fatemeh Golgiri, MD, Nahid Hashemi Madani, Zahra Emami, PhD, Kiarash Tanha, MSc	2018	Restless Legs Syndrome in Iranian People With Type 2 Diabetes Mellitus: The Role in Quality of Life and Quality of Sleep	$p < 0,001$	Hasil penelitian ini menunjukkan kualitas tidur yang buruk dipengaruhi oleh RLS (<i>Restless Legs Syndrome</i>), yaitu sensasi yang tidak nyaman pada kaki dan biasanya akan memburuk pada malam hari sehingga tidur akan terganggu akibat rasa tidak nyaman pada kaki dan menyebabkan kualitas hidup yang lebih buruk atau rendah.

7.	Rodrigo S. Delevatti, Felipe Barreto Schuch, Ana Carolina Kanitz, Cristine L. Alberton, Elisa Corrêa Marson, Salime Chedid Lisboa, Carolina Dertzbocher Feil Pinho, Luciana Peruchena Bregagnol, Maríndia Teixeira Becker, Luiz Fernando M. Kruehl	2017	Quality of life and sleep quality are similarly improved after aquatic or dry-land aerobic training in patients with type 2 diabetes: A randomized clinical trial	$p < 0,05$	Hasil penelitian ini menunjukkan latihan aerobik memiliki signifikan terhadap kualitas tidur dan kualitas hidup pada penderita diabetes mellitus.
8.	Berthiana, Wijaya Atmaja Kasuma	2020	Hubungan Kualitas Tidur Dengan Kualitas Hidup Lansia Dengan Penyakit Diabetes Mellitus Tipe 2	$p\text{-value}$ $0,000 < 0,05$	Hasil penelitian ini menunjukkan terdapat hubungan signifikan antara kualitas tidur dengan kualitas hidup lansia penderita Diabetes Mellitus Tipe 2.
9.	Akhmadi	2019	Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Lansia Dengan Penyakit Diabetes Mellitus Tipe 2 Di Klub Prolanis Sanang Barigas Palangka Raya	$p\text{-value}$ $0,000$ atau $p < 0,05$	Hasil penelitian ini menunjukkan terdapat hubungan signifikan antara kualitas tidur dengan kualitas hidup lansia penderita Diabetes Mellitus Tipe 2.
10.	Yanbing Zeng, Jielong Wu, Jiahui Yin, Jia Chen, Shu]Yu Yag, Ya Fang	2018	Association Of The Combination Of Sleep Duration And Sleep Quality With Quality Of Life In Type 2 Diabetes Mellitus	$p < 0,05$	Hasil penelitian ini menunjukkan pada durasi tidur dan kualitas tidur memiliki hubungan signifikan dengan kualitas hidup pada penderita diabetes mellitus tipe 2.

Berdasarkan tabel 4.5 menunjukkan hubungan kualitas tidur dengan kualitas hidup pada diabetes mellitus sebanyak 10 artikel yang telah diidentifikasi oleh peneliti hasilnya yaitu keseluruhan memiliki hubungan yang signifikan antara kualitas tidur terhadap kualitas hidup pada diabetes mellitus.

BAB V

PEMBAHASAN

5.1 Kualitas Tidur Pada Penderita Diabetes Mellitus

Berdasarkan hasil penelitian dari sepuluh artikel tentang kualitas tidur yang telah diperoleh didapatkan, karakteristik responden berdasarkan kualitas tidur pada penderita diabetes mellitus yaitu seluruh responden memiliki kualitas tidur yang buruk. Kualitas tidur merupakan kepuasan seseorang terhadap tidurnya, sehingga seseorang tersebut tidak memperlihatkan perasaan lelah, mudah terangsang dan gelisah, lesu dan apatis, kehitaman di sekitar mata, kelopak mata bengkak, konjungtiva merah, mata perih, perhatian terpecah-pecah, sakit kepala dan sering menguap atau mengantuk (Budiatri et al, 2013).

Faktor-faktor yang dapat mempengaruhi kualitas tidur pada diabetes mellitus yaitu faktor fisik, psikologis, sosial, dan lingkungan. Faktor fisik yang dapat menyebabkan gangguan tidur pada penderita diabetes mellitus meliputi nokturia, sering merasa haus, sering merasa lapar, nyeri dan ketidaknyamanan fisik (Zelta et al, 2015). Nokturia merupakan suatu keadaan berkemih pada malam hari yang mengganggu tidur dan siklus tidur sehingga menyebabkan penderita diabetes mellitus sulit untuk tidur kembali. Apabila kadar glukosa mencapai diatas 160 – 180 mg/dl, maka glukosa akan sampai ke air kemih. Jika kadarnya lebih tinggi lagi, ginjal akan membuang air

tambahan untuk mengencerkan sejumlah besar glukosa yang hilang, karena ginjal menghasilkan air kemih dalam jumlah yang berlebihan sehingga penderita diabetes mellitus akan sering berkemih dalam jumlah yang banyak. Hal ini dapat mengakibatkan penderita akan merasakan haus yang berlebihan sehingga akan banyak minum. Sejumlah besar kalori akan hilang saat berkemih dan akan mengalami penurunan berat badan, untuk mengkompensasi hal ini penderita diabetes mellitus akan banyak makan. Hal ini dapat mengganggu tidur penderita saat malam hari menyebabkan penderita sering terbangun di malam hari. Keluhan nyeri pada ekstremitas merupakan keluhan umum pada penderita diabetes mellitus. Sensasi yang dirasakan bermacam-macam seperti tertusuk, hal ini dapat menyebabkan penderita kesulitan untuk tidur atau sering terbangun pada malam hari (Zelta et al, 2015).

Faktor psikologis memiliki peran yang sangat penting terhadap kualitas tidur penderita diabetes mellitus. Gangguan tidur yang dialami oleh penderita 90% diakibatkan karena stress, perasaan kecemasan dan juga depresi. Stress emosional menyebabkan seseorang menjadi tegang dan seringkali mengarah frustrasi bila tidak tidur. Stress juga menyebabkan penderita sering terbangun pada saat tidur atau terlalu banyak tidur dan jika stress yang berkelanjutan akan menyebabkan kebiasaan tidur yang buruk (Zelta et al, 2015). Faktor lingkungan juga bisa mempengaruhi tidur seseorang yang menyebabkan suatu gangguan tidur pada penderita diabetes mellitus. Gangguan tidur pada faktor lingkungan, yaitu adanya suara bising,

tempat tidur yang kurang nyaman, cahaya lampu yang terlalu terang dan suhu ruangan yang panas atau terlalu dingin (Zelta et al, 2015).

Kualitas tidur seseorang dikatakan baik apabila seseorang tidak mengalami gangguan pada tidurnya, sedangkan kualitas tidur dikatakan buruk apabila seseorang mengalami gangguan pada tidurnya seperti kesulitan untuk memulai tidur dan terbangun dimalam hari atau dini hari.

Menurut peneliti, 50% penderita diabetes mellitus memiliki kualitas tidur yang buruk. Menurut penelitian dari Yoshitaka, et al (2020), sebanyak 227 responden memiliki kualitas tidur yang buruk yang diakibatkan karena adanya gangguan tidur seperti bangun untuk ke kamar mandi, mengantuk pada siang hari dan bangun terlalu pagi. Hal serupa dengan penelitian yang dilakukan oleh Azharuddin, et al (2020), sebanyak 55,3% responden memiliki kualitas tidur yang buruk yang dipengaruhi oleh adanya gangguan tidur yaitu latensi tidur dan nyeri atau rasa yang tidak nyaman. Hal serupa dengan penelitian yang dilakukan oleh Mustafa Demir (2019), responden memiliki kualitas tidur yang buruk yang dipengaruhi oleh adanya gangguan tidur yang dialami oleh responden.

Hal serupa dengan penelitian yang dilakukan oleh Berthiana, et al (2020), sebanyak 57,6% (19 responden) memiliki kualitas tidur yang buruk yang dipengaruhi oleh gangguan tidur, seperti sulit untuk memulai tidur, merasakan panas pada malam hari dan merasakan adanya peningkatan rasa haus sehingga sering terbangun pada malam hari. Hal serupa dengan

penelitian yang dilakukan oleh Akhmadi (2020), sebanyak 57,6% responden memiliki kualitas tidur yang buruk yang dipengaruhi karena responden mengalami kesulitan untuk memulai tidurnya, merasakan panas pada malam hari dan sering terbangun di malam hari.

Menurut peneliti, penderita diabetes mellitus memiliki kualitas tidur yang baik. Menurut penelitian yang dilakukan oleh Wegdan, et al (2017), sebanyak 178 responden memiliki kualitas tidur yang baik tanpa adanya gangguan tidur yang dirasakan oleh responden, sedangkan 90 responden memiliki kualitas tidur yang buruk yang disebabkan oleh adanya gangguan tidur yaitu karena responden mengalami disfungsi pada siang hari. Hal serupa dengan penelitian yang dilakukan oleh Yanbing (2018), sebanyak 589 responden memiliki kualitas tidur yang baik dan sedang dengan durasi tidur 7-8 jam, sedangkan sebanyak 209 responden memiliki kualitas tidur yang buruk yang dipengaruhi karena responden mempunyai durasi tidur lebih dari 9 jam.

Hal ini serupa dengan penelitian yang dilakukan oleh Leila, et al (2018), sebanyak 130 responden memiliki kualitas tidur yang baik tanpa adanya RLS. Sedangkan 80 responden dengan RLS memiliki kualitas tidur yang buruk yang dipengaruhi karena adanya sensasi yang tidak nyaman pada kaki dan biasanya memburuk pada malam hari. Hal ini serupa dengan penelitian yang dilakukan oleh Dong Dong, et al (2020), sebanyak 66,4% responden memiliki kualitas tidur yang baik tanpa adanya gejala kecemasan dan juga depresi. Sedangkan 3,6% responden memiliki kualitas tidur yang

buruk dipengaruhi oleh adanya gejala kecemasan dan juga adanya depresi. Hal ini serupa dengan penelitian yang dilakukan oleh Rodrigo, et al (2017), responden memiliki kualitas tidur yang baik setelah dilakukan latihan aerobik akuatik dan latihan aerobik lahan kering.

Berdasarkan pemaparan dari 10 artikel yang di dapat dijelaskan bahwa kualitas tidur yang buruk dapat dipengaruhi oleh beberapa faktor, faktor yang dapat mengakibatkan kualitas tidur buruk yaitu faktor fisik dan faktor psikologis. Faktor fisik sebabkan karena penderita mengalami gangguan tidur yang diakibatkan dari manifestasi diabetes mellitus yang diderita oleh penderita diabetes mellitus seperti nokturia, polidipsi dan nyeri yang berkepanjangan. Nyeri yang berkepanjangan disebabkan karena adanya RLS atau rasa nyeri pada ekstremitas yang dirasakan oleh penderita diabetes mellitus dan biasanya terjadi saat malam hari sehingga akan mengganggu tidur dari penderita diabetes mellitus. Faktor psikologis yang dapat mengakibatkan kualitas tidur buruk yaitu adanya kecemasan dan juga depresi yang dirasakan oleh penderita diabetes mellitus. Apabila tidak terdapat faktor yang mempengaruhi kualitas tidur, maka responden memiliki kualitas tidur yang baik. Kualitas tidur yang baik dipengaruhi juga oleh adanya latihan aerobik yang dilakukan oleh responden.

5.2 Kualitas Hidup Pada Penderita Diabetes Mellitus

Berdasarkan hasil penelitian dari kesepuluh artikel tentang kualitas hidup pada penderita diabetes mellitus yang telah diperoleh didapatkan, karakteristik responden berdasarkan kualitas hidup pada penderita diabetes mellitus diperoleh hasil seluruh responden memiliki kualitas hidup yang buruk atau rendah. Kualitas hidup (Quality Of Life) merupakan suatu kondisi dimana penderita yang menderita penyakit yang sedang di deritanya dapat tetap merasa nyaman secara fisik, psikologis, sosial maupun spiritual serta secara optimal memanfaatkan hidupnya untuk kebahagiaan dirinya maupun orang lain (Berthiana et al, 2020). Seseorang dikatakan memiliki kualitas hidup yang buruk apabila seseorang dalam keadaan yang tidak baik secara fisik, mental, dan sosial yang disebabkan oleh beberapa faktor yaitu faktor usia, jenis kelamin, tingkat pendidikan, lama menderita diabetes mellitus dan tidur. Menurut WHO (1996) terdapat empat aspek yang dapat mempengaruhi kualitas hidup pada penderita diabetes mellitus yaitu kesehatan fisik, kesejahteraan psikologi, hubungan sosial dan hubungan dengan lingkungan.

Menurut peneliti fakta yang didapat dari 10 artikel yaitu lebih dari 50% penderita diabetes mellitus memiliki kualitas hidup yang buruk. Menurut penelitian dari Berthiana, et al (2020), responden yang memiliki kualitas hidup yang buruk sebanyak 57,6% (19 responden). Hal serupa dengan penelitian yang dilakukan oleh Akhmadi (2020), sebanyak 33 responden dilihat dari kualitas hidupnya, maka responden yang paling dominan adalah kualitas hidup yang buruk dengan jumlah responden sebanyak 19 responden

(57,6%). Hal ini serupa dengan penelitian yang dilakukan oleh Dong Dong, et al (2020), sebanyak 799 responden memiliki kualitas hidup yang buruk yang dipengaruhi oleh responden memiliki kualitas tidur yang buruk dan terdapat gejala kecemasan dan depresi. Hal serupa dengan penelitian yang dilakukan oleh Yoshitaka, et al (2020), sebanyak 66,4% kualitas hidup yang buruk yang dipengaruhi oleh responden memiliki kualitas tidur yang buruk yang diakibatkan oleh adanya gangguan tidur.

Hal serupa dengan penelitian yang dilakukan oleh Wegdan, et al (2017), sebanyak 55% memiliki kualitas hidup yang buruk yang dipengaruhi oleh responden memiliki kualitas tidur yang buruk yang karena adanya disfungsi pada siang hari. Hal serupa dengan penelitian yang dilakukan oleh Azharuddin, et al (2020), responden memiliki kualitas hidup yang buruk yang dipengaruhi oleh kualitas tidur yang buruk karena adanya gangguan tidur.

Hal serupa dengan penelitian yang dilakukan oleh Yanbing (2018), sebanyak 87,9% kualitas hidup buruk yang dipengaruhi oleh responden yang memiliki kualitas tidur yang buruk yang diakibatkan oleh adanya durasi tidur yang panjang. Hal serupa dengan penelitian yang dilakukan oleh Leila, et al (2018), responden dengan kualitas hidup yang buruk dipengaruhi oleh responden memiliki kualitas tidur yang buruk yang diakibatkan oleh adanya masalah pada kakinya yaitu terdapat RLS (*Restless Legs Syndrome*).

Hal serupa dengan penelitian yang dilakukan oleh Mustafa Demir (2019), responden memiliki kualitas hidup yang buruk pada responden

kelompok intervensi. Hal ini dipengaruhi oleh fungsi fisik, fungsi sosial, fungsi peran fisik, fisik, kesehatan mental, fungsi peran emosional, kesehatan/kelelahan dan persepsi kesehatan umum.

Menurut penlitik kurang dari 50% penderita diabetes mellitus memiliki kualitas hidup yang baik. Menurut penelitian yang dilakukan oleh Rodrigo, et al (2017), responden dengan kualitas hidup yang baik setelah dilakukan latihan aerobik akuatik dan lahan kering. Kualitas hidup yang baik berpengaruh di beberapa faktor, yaitu pada domain fisik, domain psikologis, domain lingkungan dan domain hubungan sosial.

Berdasarkan hasil penelitian dari 10 artikel tentang kualitas hidup pada penderita diabetes mellitus yang telah diperoleh, didapatkan keseluruhan penderita diabetes mellitus memiliki kualitas hidup yang buruk. Kualitas hidup yang buruk sebagian besar dipengaruhi oleh faktor tidur, penderita diabetes mellitus memiliki kualitas tidur yang buruk yang disebabkan oleh adanya gangguan tidur yang dirasakan oleh responden. Adapun kualitas hidup yang buruk maupun yang baik juga dipengaruhi oleh beberapa aspek, yaitu aspek fisik, psikologi, sosial dan lingkungan. Aspek fisik seperti, kenyamanan fisik dalam melakukan aktivitas sehari-hari dan tenaga yang dimiliki. Aspek psikologi seperti, perasaan positif dan negatif, kemampuan berfikir, kemampuan dalam mengingat dan kemampuan berkonsentrasi. Aspek sosial seperti, hubungan setiap individu. Aspek lingkungan seperti, keamanan lingkungan tempat tinggal, sumber penghasilan dan kesehatan.

5.3 Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Penderita Diabetes Mellitus

Berdasarkan hasil penelitian dari kesepuluh artikel tentang hubungan kualitas tidur dengan kualitas hidup pada penderita diabetes mellitus yang telah diperoleh didapatkan hasil, penelitian dari Dong Dong, et al. (2020) dengan judul “Interaction Of Sleep Quality And Anxiety On Quality Of Life In Individuals With Type 2 Diabetes Mellitus”, menunjukkan sebanyak 33,6% responden yang mengalami kualitas tidur yang buruk yang disebabkan karena responden memiliki gejala kecemasan dan depresi. Kualitas tidur yang buruk ditambah dengan adanya gejala kecemasan dan adanya depresi yang dirasakan oleh responden dapat mempengaruhi kualitas hidup penderita diabetes mellitus sehingga kualitas hidupnya menurun atau buruk. Kualitas hidup yang buruk pada penelitian ini sebanyak 799 responden. Penelitian ini terdapat interaksi yang signifikan antara kualitas tidur yang buruk dan gejala kecemasan ini secara signifikan mengurangi skor kualitas hidup responden.

Hal serupa dengan penelitian yang dilakukan oleh Yoshitaka, et al (2020) dengan judul “Association Between Sleep Disorder And Quality Of Life In Patients With Type 2 Diabetes: A Cross-Sectional Study”, menunjukkan hasil sebanyak 342 responden yang memiliki kualitas tidur yang buruk sebanyak 66,4% yang diakibatkan karena adanya gangguan tidur seperti kesulitan tertidur, bangun di malam hari dan tidak bisa tidur kembali, bangun beberapa kali di malam hari, bangun terlalu pagi, apnea tidur, kram kaki atau terdapat masalah pada kaki, bangun untuk pergi ke kamar mandi,

keringat malam, adanya rasa sakit, mengantuk di siang hari, kesulitan untuk tetap terjaga. Gangguan tidur yang dirasakan oleh responden akan menyebabkan kualitas hidup yang buruk. Kualitas hidup yang buruk pada penelitian ini yaitu sebanyak 66,4%. Hal ini menunjukkan secara signifikan kualitas hidup yang buruk dan gangguan aktivitas secara keseluruhan pada penderita diabetes mellitus tipe 2.

Hal serupa dengan penelitian yang dilakukan oleh Wegdan, et al (2017) dengan judul “Association Between Quality of Sleep and Health-Related Quality of Life in Persons With Diabetes Mellitus Type 2”, menunjukkan hasil sebanyak 268 responden yang memiliki kualitas tidur yang buruk (kurang tidur) sebanyak 90 responden. Kualitas tidur yang buruk dipengaruhi oleh responden yang mengalami disfungsi pada siang hari. Hal ini akan berdampak pada menurunnya kualitas hidup pada penderita diabetes mellitus. Kualitas hidup yang buruk pada penelitian ini sebanyak 55% responden. Hasil dari penelitian ini kualitas tidur yang buruk lebih cenderung menunjukkan hubungan yang signifikan dengan kualitas hidup yang buruk.

Hal serupa dengan penelitian yang dilakukan oleh Azharuddin, et al (2020) dengan judul “Health-Related Quality Of Life And Sleep Quality Among North Indian Type 2 Diabetes Mellitus Patients: Evidence From A Cross-Sectional Study”, menunjukkan hasil sebanyak 300 responden yang memiliki kualitas tidur yang buruk yaitu sebanyak 55,3%. Kualitas tidur yang buruk disebabkan oleh latensi tidur dan nyeri atau rasa yang tidak nyaman yang dirasakan oleh responden, hal ini dapat memberikan efek negatif terhadap

kualitas hidup pada penderita diabetes mellitus atau kualitas hidup pada penderita diabetes mellitus akan menurun atau buruk. Hasil dari penelitian ini menunjukkan tidur yang buruk memiliki signifikan dapat menurunkan kualitas hidup secara konstan.

Hal serupa dengan penelitian yang dilakukan oleh Mustafa Demir (2019) dengan judul “Quality Of Life And Sleep In Diabetes Mellitus Patients”, menunjukkan hasil sebanyak 200 responden memiliki kualitas tidur yang buruk yang dipengaruhi oleh adanya gangguan tidur yang dialami oleh responden dan menyebabkan kualitas hidup yang terganggu, hal ini dipengaruhi oleh fungsi fisik, fungsi sosial, fungsi peran fisik, rasa sakit, kesehatan mental, fungsi peran emosional, kesehatan/kelelahan dan persepsi kesehatan umum.

Hal serupa dengan penelitian yang dilakukan oleh Leila, et al (2018) dengan judul “Restless Legs Syndrome in Iranian People With Type 2 Diabetes Mellitus: The Role in Quality of Life and Quality of Sleep”, menunjukkan hasil sebanyak 210 responden yang memiliki kualitas tidur yang buruk yaitu sebanyak 80 yang disertai dengan RLS. RLS (Restless Legs Syndrome), yaitu sensasi yang tidak nyaman pada kaki dan biasanya akan memburuk pada malam hari sehingga tidur akan terganggu, hal ini mengakibatkan adanya rasa tidak nyaman pada kaki sehingga memiliki kualitas hidup yang buruk. Hasil dari penelitian ini kualitas tidur yang buruk dikarenakan RLS signifikan terhadap kualitas hidup yang buruk pada penderita diabetes mellitus.

Hal serupa dengan penelitian yang dilakukan oleh Rodrigo, et al (2017) dengan judul “Quality Of Life And Sleep Quality Are Similarly Improved After Aquatic Or Dry-Land Aerobic Training In Patients With Type 2 Diabetes: A Randomized Clinical Trial”, menunjukkan hasil sebanyak 35 responden memiliki kualitas tidur yang buruk yang dipengaruhi oleh adanya gangguan tidur dan memiliki kualitas hidup yang buruk yang dipengaruhi oleh beberapa faktor, yaitu pada domain fisik, domain psikologis, domain lingkungan dan domain hubungan sosial. Pada latihan aerobik ini responden melakukan latihan fisik sehingga dapat menurunkan hormone stress dan meningkatkan hormone endorphin sehingga tubuh menjadi lebih baik dan kualitas hidup meningkat pada domain fisik dan emosional serta keluhan tidur yang menurun. Hasil dari penelitian ini latihan aerobik memiliki signifikan terhadap kualitas tidur dan kualitas hidup pada penderita diabetes mellitus.

Hal ini selaras dengan penelitian yang dilakukan oleh Berthiana, et al (2020) dengan judul “Hubungan Kualitas Tidur Dengan Kualitas Hidup Lansia Dengan Penyakit Diabetes Mellitus Tipe 2”, menunjukkan hasil sebanyak 33 responden yang memiliki kualitas tidur yang buruk sebanyak 57,6%. Kualitas tidur yang dialami oleh responden yaitu, seperti sulit untuk memulai tidur, merasakan panas dimalam hari, merasakan peningkatan rasa haus sehingga sering terbangun di malam hari dapat menyebabkan kualitas hidup yang buruk pada penderita diabetes mellitus. Kualitas hidup yang buruk pada penelitian ini yaitu sebanyak 57,6%. Penelitian ini menunjukkan

terdapat hubungan signifikan antara kualitas tidur dengan kualitas hidup lansia penderita Diabetes Mellitus Tipe 2.

Hal ini selaras dengan penelitian yang dilakukan oleh Akhmadi (2020) dengan judul “Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Lansia Dengan Penyakit Diabetes Mellitus Tipe 2 Di Klub Prolanis Sanang Barigas Palangka Raya”, menunjukkan hasil sebanyak 33 responden yang memiliki kualitas tidur yang buruk yaitu sebanyak 57,6% (19 responden). Kualitas tidur yang dialami oleh responden yaitu, seperti sulit untuk memulai tidur, merasakan panas di malam hari, sering terbangun di malam hari dapat menyebabkan kualitas hidup yang buruk pada penderita diabetes mellitus. Kualitas hidup yang buruk pada penelitian ini yaitu sebanyak 57,6% (19 responden). Penelitian ini menunjukkan terdapat hubungan signifikan antara kualitas tidur dengan kualitas hidup lansia penderita Diabetes Mellitus Tipe 2.

Hal ini selaras dengan penelitian yang dilakukan oleh Yanbing (2018) dengan judul “Association Of The Combination Of Sleep Duration And Sleep Quality With Quality Of Life In Type 2 Diabetes Mellitus”, menunjukkan hasil sebanyak 798 responden yang memiliki kualitas tidur yang buruk yaitu sebanyak 209 responden. Pada penelitian ini kualitas tidur yang buruk disebabkan karena durasi tidur yang berlebihan (≥ 9 jam per hari) yang berdampak pada menurunnya kualitas hidup penderita diabetes mellitus tipe 2. Kualitas hidup yang buruk pada penelitian ini yaitu sebanyak 87,9%. Hasil dari penelitian ini yaitu pada durasi tidur dan kualitas tidur memiliki

hubungan signifikan dengan kualitas hidup pada penderita diabetes mellitus tipe 2.

Penderita diabetes mellitus biasanya memiliki kualitas tidur yang buruk yang diakibatkan karena adanya gangguan tidur yang dapat menyebabkan adanya penurunan toleransi glukosa dan berdampak pada kemampuan penderita diabetes mellitus dalam melakukan kegiatan sehari-hari. Hal ini akan menurunkan kualitas hidup pada penderita diabetes mellitus (Chasesns, 2008). Namun hal ini dapat dicegah dengan memenuhi kebutuhan dasar manusia yaitu tidur yang cukup dan berkualitas. Tidur yang berkualitas akan memberikan dampak yang baik bagi kesehatan penderita diabetes mellitus seperti energy yang cukup serta meningkatkan system pertahanan tubuh. Kualitas tidur yang baik pada penderita diabetes mellitus akan menaikkan toleransi glukosa insulin sehingga glukosa dapat dipecah dengan baik dan gula darah akan cenderung normal (Yusra, 2010).

Menurut peneliti, penderita diabetes mellitus memiliki kualitas tidur yang buruk yang diakibatkan karena ada beberapa faktor yang dapat mempengaruhi kualitas tidur yaitu faktor fisik seperti adanya gangguan tidur yang disebabkan oleh nokturia dan nyeri pada ekstremitas. Faktor psikologis yang dapat mempengaruhi kualitas tidur yaitu adanya depresi dan kecemasan yang dirasakan oleh penderita diabetes mellitus. Hal ini jika terjadi secara berkelanjutan berdampak pada menurunnya kualitas hidup penderita diabetes mellitus. Hal-hal yang dapat memperburuk kualitas hidup pada penderita diabetes mellitus bisa diatasi dengan manajemen dan kontrol diri yang baik.

Mengikuti pola hidup sehat, memenuhi kebutuhan dasar seperti tidur yang cukup dan berkualitas.

BAB VI

PENUTUP

6.1 Kesimpulan

6.1.1 Kualitas Tidur Pada Penderita Diabetes Mellitus

Hasil analisa kualitas tidur berdasarkan *literature review* dari kesepuluh artikel, menunjukkan 5 artikel memiliki kualitas tidur yang buruk. Kualitas tidur yang buruk dipengaruhi oleh faktor fisik yaitu adanya gangguan tidur yang diakibatkan oleh nokturia dan nyeri pada ekstremitas. Serta adanya faktor psikologi seperti gejala kecemasan dan adanya depresi yang dirasakan oleh penderita diabetes mellitus. Sedangkan 5 artikel lainnya memiliki kualitas tidur yang baik.

6.1.2 Kualitas Hidup Pada Penderita Diabetes Mellitus

Hasil analisa kualitas hidup pada diabetes mellitus berdasarkan *literature review* dari kesepuluh artikel, menunjukkan lebih dari 50% memiliki kualitas hidup kualitas hidup yang buruk. Kualitas hidup yang buruk disebabkan oleh faktor tidur dan juga empat aspek yang mempengaruhi kualitas hidup penderita diabetes, yaitu aspek fisik, psikologi, sosial dan lingkungan. Sedangkan selebihnya memiliki kualitas hidup yang baik setelah dilakukan latihan aerobik.

6.1.3 Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Penderita Diabetes Mellitus

Hasil analisa kualitas tidur dengan kualitas hidup pada diabetes mellitus berdasarkan *literature review* dari kesepuluh artikel, keseluruhan memiliki hubungan yang signifikan antara kualitas tidur dengan kualitas hidup pada penderita diabetes mellitus.

6.2 Saran

6.2.1 Bagi Masyarakat

Masyarakat khususnya penderita diabetes mellitus perlu adanya edukasi terkait kualitas tidur yang baik untuk meningkatkan kualitas hidup pada penderita diabetes mellitus.

6.2.2 Bagi Instansi

Untuk instansi pendidikan perlu adanya buku atau jurnal mengenai hubungan kualitas tidur dengan kualitas hidup pada penderita diabetes mellitus sebagai tambahan referensi untuk melengkapi *literature review*.

6.2.3 Bagi Peneliti Selanjutnya

Bagi peneliti selanjutnya dapat memperdalam cakupan penelitian dengan mencari artikel-artikel yang lebih luas untuk melengkapi *literature review* ini.

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RESEARCH

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Interaction of sleep quality and anxiety on quality of life in individuals with type 2 diabetes mellitus



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Abstract

Purpose: Sleep disturbances and anxious symptoms are very common in people with type 2 diabetes mellitus (T2DM). This study aimed to assess the interactive effects of poor sleep quality and anxious symptoms on the quality of life of people with T2DM.

Methods: Nine hundred and forty-four participants with T2DM were enrolled in a cross-sectional study. Demographic and physiological characteristics were recorded. Each participant completed a Chinese version of the Pittsburgh Sleep Quality Index, the Patient Health Questionnaire-9 and General Anxiety Disorder questionnaire, and the Diabetes Specificity Quality of Life scale. The products of poor sleep quality and anxiety were added to a logistic regression model to evaluate the multiplicative interactions, expressed as the relative excess risk of interaction, the attributable proportion of interaction, and the synergy index.

Results: Poor sleep quality and anxiety symptoms were associated with reduced quality of life. There was a significant interaction between poor sleep quality and anxiety symptoms; this combined effect significantly reduced quality of life scores by 6.09-fold. The relative excess risk of interactions was 1.36.

Conclusions: The combined effect of poor sleep quality and anxiety symptoms reduces quality of life in people with T2DM.

Trial registration: ChiCTR-IOP-16008045. Registered 3 March 2016.

Introduction

The prevalence of diabetes has been increasing globally, with an estimated number of 592 million diabetes cases by 2035 [1]. In China, more than 100 million people (approximately 1 in 10) have diabetes [2]. Because of unstable glycemic control, diabetes can affect any organ in the body, leading to serious complications over time [3].

Diabetes and its complications result in significant economic burden for individuals, families, and health care systems. The rate of glycemic control in T2DM is only 17.4% in China [4]. To maintain control of blood glucose and reduce complications, people with diabetes require lifelong dietary restrictions, physical exercise, medication compliance, and blood glucose monitoring [5]. During

this long-term, self-management process, many individuals experience emotional burdens and poor sleep quality in response to these prolonged requirements, including worry about complications, fear of

hypoglycemia, feelings of guilt about uncontrolled blood glucose, and depressed mood [6].

Anxiety is one of the most common comorbidities of people with T2DM [7] and its prevalence ranges from 22.4 to 75% [8]. In people with T2DM, comorbid anxiety disorders are associated with an increase in complications [8], poorer blood glucose levels [8], poor adherence to treatment [9], reduced quality of life [7]. Sleep disturbances are very common symptoms in people with T2DM, who show a 30 to 50% prevalence of poor sleep quality [10]. Sleep disturbance in people with T2DM can result in impaired glucose regulation and quality of life [11]. Even after controlling for age, years since diabetes diagnosis, number of comorbidities, number of diabetic complications, insulin use and depressive symptoms, Poor sleep quality in people with T2DM still significantly reduce diabetes-related quality of life [12].

Although anxiety and poor sleep quality have been shown to be individually correlated with quality of life in people with T2DM, no studies have addressed the joint effects of these factors on T2DM. Hence, the aim of this study was to examine the joint effects of poor sleep quality and anxiety symptoms on quality of life of people with T2DM in primary care in China.

Materials and methods

Study design

Xuzhou City locates in northern Jiangsu Province, eastern part of China, and is moderately well-developed with a population of 10,000,000 across all area. More than 24 ten thousand persons with T2DM have registered in 3980 communities of Xuzhou City, average number of 60 patients in each community. The methods that enrolled participants in the study had been described previously [4]. The prevalence of anxiety is higher than that of poor sleep quality in people with T2DM in China [4, 13]. Considering 30% prevalence of poor sleep quality in patients with T2DM [4] with a 90% power and $\alpha = 0.05$, and allowing for a refusal of 10%, at least 900 people must be selected. The study was conducted in September 2017.

Inclusion and exclusion criteria

Participants had to meet the recommended criteria of the Chinese Type 2 Diabetes Prevention and Control 2010 Guidelines [3]. The following exclusion criteria were used: (1) participant was diagnosed with Type 2 diabetes mellitus by physicians at least 6 months; (2) Type 1 diabetes mellitus; (3) painful diabetic sensory neuropathy; (4) diagnosed sleep disorders prior to diabetes; (5) mental illness or use of any kind of psychotropic medication; (6) working night shifts in the last 3 months or travelling across time zones in the last month; (7) other endocrine disorders, such as thyroid

disease or chronic use of glucocorticoids; (8) age < 18 years; (9) pregnancy or lactation, (10) medically unstable condition; (11) harmful or hazardous alcohol user; (12) Receiving sleep treatment; (13) Another sleep disorders such as obstructive sleep apnea.

A total of 1056 eligible T2DM patients aged 27–97 years old were invited into the study. Among them 23 patients dropped out due to working, 27 patients refused to take part in the study, and nine patients failed to complete the questionnaire. Finally, 997 individuals with T2DM from 44 communities who met the criteria were enrolled in the study. The response rate was 94.4%.

Written informed consent was obtained from all participants. The study protocol was approved by Xuzhou Center for Disease Control and Prevention. The procedures followed were in accordance with the standards of the ethics committee of Xuzhou Center for Disease Control and Prevention and with the Declaration of Helsinki (1975, revised 2000). The trial was prospectively registered with the Chinese Clinical Trials Registry (reference: ChiCTR-IOP-16008045).

Sleep quality

The Pittsburgh Sleep Quality Index (PSQI) is a 19-item, self-report questionnaire that measures sleep quality and degree of sleep difficulties over the past month [14]. It contains seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. These are summed to yield a total PSQI score with a range of 0–21; higher scores indicate poorer sleep quality. The Chinese version of the PSQI has a diagnostic sensitivity of 98.3% and specificity of 90.2% in distinguishing people with and without sleep quality problems [15]. In our study, a PSQI score of < 7 and ≥ 7 was defined as “good sleep quality” and “poor sleep quality,” respectively.

Anxiety and depression

Depression symptoms were assessed with the Patient Health Questionnaire-9 (PHQ-9), a nine item scale with scores ranging from 0 to 27; scores of 10 or more are indicative of depressive symptoms [16]. The Chinese version of PHQ-9 had been well validated in many studies [17–19] and demonstrated a good internal consistency in those study, with a Cronbach's α coefficient of 0.81. Anxiety Symptoms were measured with the validated seven-item General Anxiety Disorder questionnaire (GAD-7; total score range 0–21) [20], and participants were defined as having the anxious symptoms if they scored ≥ 10 . The Chinese version of GAD-7 has been widely used and well validated in many studies [21, 22] and demonstrated good internal consistency in those study, with a Cronbach's α coefficient of 0.88.

Quality of life

The Diabetes Specificity Quality of Life Scale (DSQL) was used to assess quality of life. This is a validated questionnaire developed by Chen et al. [23] to assess people with Type 2 diabetes mellitus in China. The scale contains 24 items, which generate four domain scores reflecting physiological, psychological, social, and therapy-related problems with quality of life. The sum of the four domain scores produces a global quality of life score with a range of 24–120 points; higher scores indicate poorer quality of life. A DSQL score < 40 has a diagnostic sensitivity of 94.5% and specificity of 91.0% in differentiating good from poor quality of life [23].

Other variables

We designed an additional questionnaire to record age, sex, level of education, marriage status, physical activities, net household income, cigarette smoking, alcohol consumption, years since diabetes diagnosis, number of comorbidities, number of diabetic complications, and insulin use. The number of diabetic complications was determined by participants' reports of diagnosed coronary artery disease, peripheral vascular disease, stroke, nephropathy, retinopathy, or neuropathy. All fasting venous blood samples were drawn between 8:00 AM and 9:00 AM. We used the level of HbA1c as the index for glycemic control. HbA1c level was assayed using high-performance liquid chromatography (BIO-RAD Diagnostic Group, CA, USA). A level of HbA1c of 53 mmol/mol (< 7.0%) was defined as good glycemic control based on the Chinese Type 2 Diabetes Prevention and Control 2010 Guidelines and a level of HbA1c of $\geq 7.0\%$ (53 mmol/mol) was considered poor glycemic control [3]. Body weight and height were measured to the nearest 0.1 kg and 0.1 cm in light indoor clothing, respectively. Body mass index (BMI) was calculated as weight (kg) divided by the square of the height (meters), and categorized as underweight (< 18.5 kg/m²), normal weight (18.5–23.9 kg/m²), and overweight/obese (≥ 24.0 kg/m²) [24]. Alcohol user was assessed by the Alcohol Use Disorders Identification Test [25], and a total score was summed by 10 items including the frequency and amount of alcohol use and symptoms of dependence. Scores of ≥ 20 indicated harmful and hazardous levels of alcohol use in need of treatment [26]. Obstructive sleep apnea (OSA) was screened by using the STOP-Bang questionnaire, and participants were defined as OSA if they scored ≥ 3 [27].

Statistical analysis

All statistical analyses were performed using SPSS version 16.0 (Chicago, SPSS Inc.). Differences in continuous variables were tested using F tests or t tests and differences in categorical variables were assessed using the

Pearson chi-square test. The DSQL score representing quality of life was the dependent variable. The associations between sleep quality, anxiety symptoms, and quality of life were determined using binary logistic regression. The correlations between PSQI and DSQL scores, and between SAS and DSQL scores were used Pearson Correlation. The results were stratified in terms of sleep quality (good sleep quality = a PSQI global score < 7, equal to 0, versus poor sleep quality = a PSQI global score ≥ 7 , equal to 1) and anxiety (anxiety symptoms = an GAD-7 score ≥ 10 versus few symptoms = GAD-7 < 10), and were adjusted for age (continuous), sex (males or females), educational level (less than high school, high school, or greater), marital status, physical activities (yes or no), net household income (continuous), cigarette smoking (yes or no), alcohol consumption (yes or no), years since diabetes diagnosis (continuous), comorbidities (yes or no), diabetic complications (yes or no), insulin use (yes or no), glycemic control (yes or no), and DSQL score (A DSQL score < 40 was represented as equal to 0 and a DSQL score ≥ 40 was represented as equal to 1). A cross-product interaction term was included in the logistic regression model to assess multiplicative interactions. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated using the contrast statement in SPSS 16.0. Variance was calculated using the Taylor series linearization method, which leads to an asymptotically unbiased estimate. All associations reported were statistically significant ($P < 0.05$) using two-tailed tests.

To estimate the biological interaction between sleep quality and anxiety, we created three new variables: 1) PSQI global score < 7 = no and anxiety = yes, versus others; 2) PSQI global score ≥ 7 = yes and anxiety = no, versus others; and 3) PSQI global score ≥ 7 = yes and anxiety = yes, versus others [28].

The relative excess risk due to interaction (RERI), the attributable proportion due to interaction (AP), and the synergy index (S) were used to estimate biological interactions [28]. The RERI is the excess risk attributed to interaction relative to the risk without exposure. AP refers to the attributable proportion of disease caused by interaction in subjects with both exposures. S is the excess risk from both exposures when there is a biological interaction relative to the risk from both exposures without interaction. In the absence of additive interactions, RERI and AP are equal to 0 [28]. The current study refined the criteria as a statistically significant RERI > 0, AP > 0, or S > 1 to indicate biological interactions.

Results

General participant characteristics

The mean age of participants was 64.1 ± 10.2 years, and 61.3% were female. The mean age of non-respondents

was 63.8 ± 10.1 years, and 59.9% were female. There were no significant differences between participants and non-respondents ($P > 0.05$). The average DSQL score was 50.7 ± 12.9 , and males had lower DSQL scores than females (48.8 ± 12.7 vs. 51.9 ± 13.1 , $P < 0.01$). A total of 19.9% of the sample reported having good quality of life (a DSQL score < 40). A total of 17.3% participants were smokers, 11.9% were alcohol drinkers, 64.2% did not have any comorbidity, and 12.4% were treated with insulin. Participants had an average duration of 5.6 ± 5.1 years since Type 2 diabetes mellitus diagnosis. The distribution of participants' general characteristics is presented in Table 1.

Rates of poor sleep quality and anxiety symptoms

The prevalence of poor sleep quality was 33.6%. The rate of poor sleep quality was 16.7% (33/198) in participants with good quality of life and 37.8% (302/799) in participants with poor quality of life ($\chi^2 = 30.74$, $P < 0.01$). Among the participants, 65.4% had anxiety symptoms. The prevalence of anxiety symptoms was 45.5% (90/198) in participants with good quality of life and 70.3% (562/799) in those with poor quality of life ($\chi^2 = 40.39$, $P < 0.01$). The rates of poor sleep quality and anxiety symptoms were lower in participants with good quality of life than in those with poor quality of life (Table 1).

Table 1 Distribution of participants' general characteristics according to quality of life

Variables	Good <i>n</i> = 198	Poor <i>n</i> = 799	<i>P</i>
Age > 60	61.7±8.7	65.5±10.9	<0.001
Above high school	20 (10.1)	67 (8.4)	0.555
No spouse	27 (13.6)	131 (16.4)	0.284
Regular exercise	174 (87.9)	622 (77.8)	0.003
Income below population average (%)	100 (50.5)	416 (52.1)	0.799
BMI, mean (SD)	24.1±2.5	23.8 ± 2.9	0.193
Median of disease duration (years)	3.8 ± 3.6	6.1 ± 5.3	<0.001
Comorbidities	49 (24.7)	308 (38.5)	0.001
Complications	14 (7.1)	75 (9.4)	0.286
Smokers	39 (19.7)	133 (16.6)	0.328
Drinkers	36 (18.2)	83 (10.4)	0.004
Using insulin	7 (3.5)	117 (14.6)	<0.001
Depression	52 (26.3)	348 (43.6)	<0.001
Anxiety	90 (45.5)	562 (70.3)	<0.001
PSQI> 7	33 (16.7)	302 (37.8)	<0.001
HbA1c < 7%	63 (31.8)	110 (13.8)	<0.001

BMI Body mass index, *HbA1c* Glycated hemoglobin, *DSQL* Diabetes Specificity Quality of Life Scale. Comorbidity refers to disease accompanying diabetes;

The correlations between PSQI and DSQL scores, and between GAD-7 and DSQL scores were positive, with correlation coefficients of 0.415 and 0.386, respectively (all $P < 0.001$).

Biological interaction of sleep quality and anxiety symptoms on quality of life

The results from the multiple logistic regression models indicate the interaction using a combined effects method, with the P value of the interaction term indicating statistical significance of multiplicative interactions (Table 2). Participants with both poor sleep quality and anxiety symptoms had a significantly increased risk of reduced health status as measured by DSQL scores compared with those with neither poor sleep quality nor anxiety (OR: 7.45; 95% CI: 4.54–11.02; $P < 0.001$). In addition, those with poor sleep quality with no anxiety symptoms had a significantly higher risk of reduced health status as indicated by DSQL scores compared with those with neither poor sleep quality nor anxiety (OR: 3.48; 95% CI: 2.22–7.31; $P < 0.001$). Anxious participants who were good sleepers also had reduced health status compared with those who had neither poor sleep quality nor anxiety (OR: 2.55; 95% CI: 1.76–4.06; $P < 0.001$; (Table 2).

There was an additive interaction between poor sleep quality and anxiety symptoms (RERI, 2.27; 95% CI: 1.09–4.87; Table 3). Therefore, the OR of reduced DSQL score in participants with Type 2 diabetes mellitus and anxiety symptoms is 2.27 times higher as a result of the additive interaction compared with participants with good sleep quality and no anxiety, with 29% of declining health status attributed to the interaction between poor sleep quality and anxiety.

Discussion

We found that poor sleep quality was associated with a reduced DSQL score in participants with Type 2 diabetes mellitus. The addition of anxiety symptoms further augmented the decreased outcomes in participants with poor sleep quality, suggesting a greater reduction in

Table 2 Odds ratios for the association between sleep quality and quality of life by anxiety symptoms in participants with Type 2 DM

Sleep quality	Anxiety symptoms	Quality of life		
		Good (<i>n</i> =198)	Poor (799)	OR ^a (95% CI)
Good	< 50	91	147	1
Good	≥50	74	350	2.55 (1.76–4.06)
Poor	< 50	16	90	3.48 (2.22–7.31)
Poor	≥50	17	212	7.45 (4.54–11.02)

^acomplication refers to a disease caused by diabetes, *PSQI* Pittsburgh Sleep Quality Index

Table 3 Estimates of biological interaction between sleep quality and anxiety symptoms and its effects on quality of life in participants with Type 2 DM

Measures of biological interaction	Estimate (95% CI)
RERI	2.27 (1.09–4.87)
AP	0.29 (0.12–0.43)
S	1.46 (1.22–1.96)

Reference group is PSQI score > 7 and anxiety symptom score < 50

Models were adjusted for age, sex, education level, marital status, exercise, income, BMI, disease duration, comorbidity, complications, smoking, drinking, insulin use, and depression

quality of life in participants with both poor sleep quality and anxiety than in participants experiencing only poor sleep quality or only anxiety. To the best of our knowledge, this is the first study to elucidate the effect of poor sleep quality plus anxiety on these variables.

Several possible mechanisms may explain the combined effects of poor sleep quality and anxiety on quality of life reduction in participants with Type 2 diabetes mellitus. First, previous work suggests a positive significant association of PSQI global scores with anxiety [29]. Both factors affect quality of life of people with diabetes through biological pathways. Poor sleep quality and anxiety both activate the hypothalamic-pituitary-adrenal axis, stimulating sympathetic nervous system-adrenal responses, increasing platelet aggregation and inflammation, decreasing insulin sensitivity, and worsening glycemic control [30]. Poor sleep quality stimulates the central nervous system to secrete large amounts of catecholamines, which are released into the blood and lead to elevated blood sugar [31]. Research shows that poor glycemic control is related to reduced quality of life of people with diabetes [32].

Second, poor sleep quality and anxiety are both directly related to poor glycemic control [9, 33], poor sleep quality, decreased diabetes self-management, increased food intake, alterations in the timing and amount of food intake, preference for high energy food, impaired glucose tolerance and insulin sensitivity [34, 35]. Conversely, a chronic high fat, high protein diet and delicious food can increase fasting blood glucose, leading to anxiety [36]. Anxiety disorders correlate directly with poor adherence to treatment, inadequate glycemic control, and increased adrenergic activity [9]. In addition, research indicates that low fat diets can improve the quality of life of people with Type 2 diabetes mellitus [37].

Anxiety and poor sleep quality have a combined effect on glycemic control, which decreases the quality of life of people with Type 2 diabetes mellitus. These findings suggest that a combination of poor sleep quality and anxiety may reduce the quality of life of people with Type 2 diabetes mellitus.

Our results have substantial significance for public health. In the fully adjusted models, we estimated that 29% of the reduced quality of life of participants with Type 2 diabetes mellitus can be explained by an interaction between poor sleep quality and anxiety symptoms. The findings suggest that clinicians treating anxiety complaints in patients with Type 2 diabetes mellitus should screen for poor sleep quality, and vice versa. Efficacious behavioral and pharmacologic treatments exist for both anxiety disorders and poor sleep quality in people with Type 2 diabetes mellitus [38, 39]. Therefore, it is necessary to identify and implement best practice into routine health care in order to integrate health services for comorbid anxiety and diabetes in different types of service and in different countries. The application of either an anxiety- or sleep-focused intervention could produce relief for both symptoms, maximizing improvements in people's quality of life. Given the difficulty in treating poor sleep quality or anxiety in certain people, recommendations to prevent these health problems are an inexpensive and practical means of improving quality of life in people with Type 2 diabetes mellitus.

Limitations of this study include the reliance on self-reported measures of poor sleep quality and anxiety levels. In addition, the cross-sectional nature of this sample means that the temporal order of causality cannot be inferred. Future research needs to address these limitations. Third, although we used reliable and valid measures of sleep quality and anxiety, these measures did not constitute clinical diagnoses of poor sleep quality and anxiety disorder. Future research should use clinical measures of sleep quality and anxiety to examine their effects on quality of life. Fourth, other confounding factors, such as hypoglycemia, dietary lifestyle, could not be adjusted in this study. Future research should consider the effects of adjusted dietary lifestyle on quality of life, and the effectiveness of sleeping and psychological intervention. Fifth, our sample was limited to Chinese participants; our findings need to be replicated in other ethnic populations.

Conclusions

Poor sleep quality and anxiety symptoms all reduce quality of life in participants with Type 2 diabetes mellitus. Moreover, there was a combined effect of poor sleep quality and anxiety on reduced quality of life. As poor sleep quality and anxiety are common symptoms, the appropriate identification and treatment of these symptoms in people with Type 2 diabetes mellitus is very important to improve their quality of life.

Abbreviations

T2DM: Type 2 diabetes mellitus; PSQI: Pittsburgh Sleep Quality Index; PHQ-9: Patient Health Questionnaire-9; GAD-7: General Anxiety Disorder

questionnaire; DSQL: The Diabetes Specificity Quality of Life Scale;

HbA1c: Glycated hemoglobin; BMI: Body mass index; OSA: Obstructive sleep apnea; ORs: Odds ratios; CIs: Confidence intervals; RERI: Relative excess risk due to interaction; AP: Attributable proportion due to interaction; S: Synergy index

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None of the authors have any relevant conflicts of interest to disclose.

Novelty statement

There was a joint effects of poor sleep quality and anxiety symptoms on quality of life of people with diabetes.

Authors' contributions

DD conceived and designed the study, acquired and analyzed data, and drafted the manuscript. PL conceived and designed the study, acquired and analyzed data, reviewed the manuscript, obtained funding, and supervised the study, and the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. JW designed the methods, provided administrative support, acquired data, reviewed the manuscript, and supervised the study, contributed to the introduction. PZ acquired and analyzed data, reviewed the manuscript, and provided administrative support, contributed to the introduction. JS acquired data, reviewed the manuscript, and supervised the study, contributed to the discussion. GC conceived the study, acquired data, and reviewed the manuscript, contributed to the discussion. CX researched data, contributed to the discussion, and edited the manuscript. The author(s) read and approved the final manuscript.

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Availability of data and materials

Please contact author for data requests.

Ethics approval and consent to participate

Written informed consent was obtained from all the participants. The study protocol was approved by the Xuzhou Center for Disease Control and Prevention (2011710). The procedures followed were in accordance with the standards of the ethics committee of Xuzhou Center for Disease Control and Prevention and with the Declaration of Helsinki (1975, revised 2013).

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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RESEARCH ARTICLE

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Association between sleep disorder and quality of life in patients with type 2 diabetes: a cross-sectional study

Yoshitaka Hashimoto¹, Ryosuke Sakai¹, Kenichiro Ikeda² and Michiaki Fukui^{1*}

Abstract

Background: We investigated the association between sleep symptoms, which cause sleep disorder, and quality of life (QoL) among people with type 2 diabetes (T2D).

Methods: In this cross-sectional study of 342 people with T2D, the Japan National Health and Wellness Survey (NHWS) database 2016 were used. We treated the respondents who reported experiencing any of the sleep symptoms as having sleep disorders. To examine health-related QoL (HRQoL), we used the physical component summary (PCS) and the mental component summary (MCS) from the 36-Item short-form and the EuroQol 5 Dimension (EQ-5D) survey instruments. Overall activity impairment was used for assessment of the effect on the individual's ability to perform regular daily activities. We used t-test and one-way ANOVA test for comparison QoL scores between the participants with and without sleep disorders.

Results: 66.4% of the participants with T2D reported having a sleep disorder. The PCS, MCS, EQ-5D, and overall activity impairment of people with sleep disorder was significantly poorer than those of the people without.

Specific sleep symptoms, such as waking up to go to the bathroom, daytime sleepiness, and waking up too early (before the alarm clock), had high prevalence (35.4, 27.8 and 20.2%). The participants who experienced waking up to go to the bathroom or daytime sleepiness demonstrated significantly poorer QoL on all scores related to QoL, but those who experienced waking up too early only demonstrated significantly poorer QoL on the EQ-5D.

Conclusions: Two-thirds of people with T2D in this study suffer from sleep disorders. The people who experience waking up to go to the bathroom or daytime sleepiness had significantly poorer QoL than those without these symptoms.

Background

The number of people with type 2 diabetes (T2D) is now increasing. The overall treatment goal of diabetes is to prevent diabetic complications, while maintaining quality of life (QoL). Reports show that the QoL of people with

diabetes is lower than that of people without diabetes [1]. Health-related QoL (HRQoL) includes aspects of QoL that may affect physical or mental health [2]. Furthermore, there is a close association between HRQoL values and glycemic control in people with T2D [3, 4]. Thus, to prevent a decline in the QoL of people with T2D is treatment target for the management of diabetes.

Sleep disorder, which many people with T2D suffer, [5] is one of the factors impairing QoL in people with

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T2D. According to an internet survey of over 7 thousands people in the United States with T2D, three-quarters of participants suffered from sleep symptoms, and one-quarter of them were actually diagnosed with a sleep disorder [6]. Also, reports show that about half of people with T2D in Japan have sleep disorder [7]. Furthermore, in a study of almost 1 thousand Chinese people with T2D, 33.6% suffered from poor sleep quality, and there was an association between the pittsburgh sleep quality index and QoL [8]. These studies were based on the sleep disorder scores. These scores and sleep duration significantly correlate with QoL values in people with T2D [9, 10]. Generally, these sleep disorder scores were meaning the summary of symptoms in previous studies. We couldn't specify which symptoms impact on patient's QoL. Thus, we investigated the relationship between specific sleep-related symptoms and QoL in people with T2D.

Methods

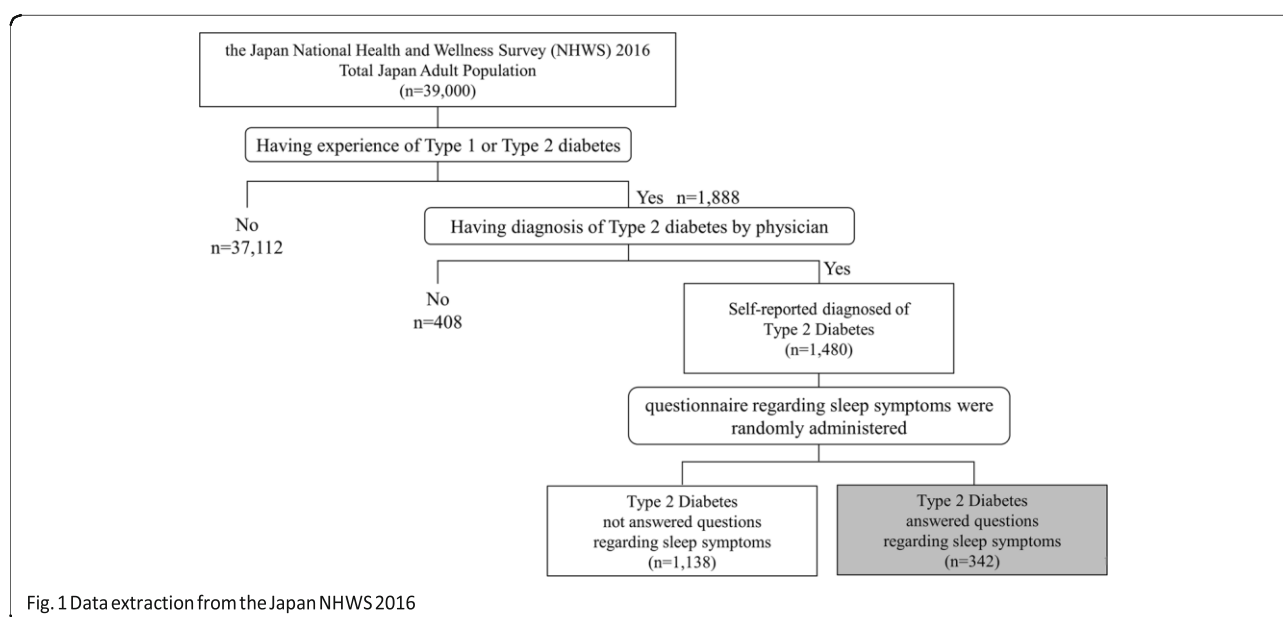
Study design and participants

This cross-sectional study is based on the data of the Japan National Health and Wellness Survey (NHWS) 2016 ($N = 39,000$), which is a self-administered, internet-based questionnaire from a nationwide sample of adults (aged 18 years or older). In this survey, participants, were recruited through a random sampling approach, stratified by age and gender, are required to provide various information [11, 12]. The survey received Institutional Review Board approval and all respondents provided written informed consent prior to participating. Potential respondents for this study were identified through the general panel of Lightspeed Research (LSR). Panel members are general people who explicitly agreed to join this

panel. The LSR members were recruited through a variety of means, including co-registration with other internet panels, e-newsletter campaigns, and banner placements. The NHWS sample is generally comparable to the greater population concerning these characteristics [11–13]. We extracted the data including self-reported diagnosis of type 2 diabetes from the Japan NHWS 2016. At first, all respondents were asked if they have ever experienced Type 1 or Type 2 Diabetes. For respondents who responded “yes” to this question, they were asked if their Type 2 Diabetes has been diagnosed by a physician. Respondents who answered “yes” to the second question were classified as T2D patients in the study. Among this T2D patients, we selected the individuals who answered questions regarding sleep symptoms. In addition, the questions about sleep symptoms were randomly administrated from all participants in the Japan NHWS 2016 (Fig. 1).

Clinical and sociodemographic profiles

Using the questionnaire, age, sex, marital status (married/living with partner, or not married), education (university degree or all others), household income (< 3,000,000 JPY, 3,000,000 to < 5,000,000 JPY, 5,000,000 to < 8,000,000 JPY, 8,000,000 JPY or more, or decline to answer), health insurance (national health insurance, social insurance, late stage elderly insurance, or other/no insurance), and employment status (currently employed or not). Additional questions include: smoking (current, former, or never smoker), exercise (currently exercise or not), alcohol use (currently consume alcohol or not), body mass index (BMI) category (underweight; BMI < 18.5 kg/m², normal weight; 18.5 kg/m² ≤ BMI < 25 kg/



m², overweight; $25 \text{ kg/m}^2 \leq \text{BMI} < 30 \text{ kg/m}^2$, obese; $30 \text{ kg/m}^2 \leq \text{BMI}$, or decline to answer), taking steps to lose weight (yes or no), Charlson comorbidity index (CCI), HbA1c level ($\text{HbA1c} < 7$, $\text{HbA1c} \geq 7$, or don't know), use of injectable medicines (yes or no), and ever experienced hypoglycemia (yes, no, or don't know). BMI (kg/m^2) was calculated as person's weight (kg) divided by the square of height (m²).

Definition of sleep disorders

This study treats respondents who reported experiencing any of the sleep symptoms as having sleep disorders [6]. Sleep symptoms were made referencing the Diagnostic and Statistical Manual of Mental Disorders [14].

Definition of QoL

HRQoL was assessed using the 36-Item short-form (SF-36v2) and the EuroQol 5 Dimension (EQ-5D) survey instruments. The SF-36v2 is a multipurpose, generic HRQoL instrument comprising 36 questions that map onto 8 health domains, and these relevant scores are summarized into the physical component summary (PCS) and the mental component summary (MCS) [15–17]. Higher scores indicate a better QoL. Validation of these score was confirmed in Japanese population [16]. The EQ-5D is an instrument that evaluates the generic QoL, which is a standardized measure of health status to provide a simple, generic measure of health [18]. EQ-5D were widely used in various countries and diseases [19–23]. This questionnaire and descriptive system comprising five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) with five levels of severity [24] and then responses were converted into a single health index by applying a formula [24]. Higher scores indicate a better health status. Overall activity impairment was assessed using the Work Productivity and Activity Impairment (WPAI) questionnaire [25]. The WPAI was validated in number of disease states [25, 26]. This is a 6-item validated instrument that consists of four metrics: presenteeism, absenteeism, overall work productivity loss, and overall activity impairment. Overall activity impairment is one of the WPAI's metrics and is showing the percentage of impairment in daily activities because of one's health in the past 7 days. Overall activity impairment subscales are expressed as percentages and higher percentages indicate greater impairment.

Statistical analysis

We compared demographic and general health characteristics with and without sleep disorders. We also compared QoL, including HRQoL and overall activity impairment, based on the presence or absence of sleep disorders and of specific sleep symptoms. T-test and one-way ANOVA test

were used for continuous variables and the Chi-square test for categorical variables.

Subsequently, the QoL associated with the presence or absence of sleep disorders or of specific sleep symptoms were compared by multivariable analysis (generalized linear model), adjusting for age, sex, marital status, level of education, Charlson comorbidity index, smoking status, alcohol use, BMI category, taking steps to lose weight, duration of diabetes, HbA1c level, use of injectable medications, and experience with hypoglycemia. We selected the specific sleep symptoms of waking up to go to the bathroom, daytime sleepiness, and waking up too early (such as before the alarm clock) for multivariable analysis because the prevalence rates of these symptoms were over 20%.

There was a significant difference when the *p*-value was less than 0.05. All data analyses were performed using IBM SPSS Statistics Version 22.

Results

According to the Japan NHWS database 2016 ($N = 39,000$), 1480 participants were identified as having T2D. Among these T2D, the questionnaire about condition of sleep were randomly applied. Three hundred-forty two participants responded the questionnaire, and we analyzed the data of these respondents.

Table 1 shows the clinical characteristics of the 342 participants. The mean (SD) age and duration of diabetes were 63.25 (10.21) and 13.54 (10.59) years, and 82.5% of the participants were men. Out of the 342 participants, 15.5% used injectables and 27.8% had experienced hypoglycemia.

Table 2 shows the prevalence of sleep symptoms in the participants. 66.4% reported some sleep symptoms. For individual symptoms, 35.4% wake up to go to the bathroom, 27.8% suffer daytime sleepiness, and 20.2% wake up too early (such as before the alarm clock).

Table 3 shows the clinical characteristics difference between participants with/without sleep disorders. The proportion of current smoker, worse HbA1c, and experience with hypoglycemia were higher in the participants with sleep disorders than those in the participants without.

Table 4 shows the QoL difference between participants with/without sleep disorders. The PCS, MCS, EQ-5D of the participants with sleep disorders were lower than those of the participants without. In addition, overall activity impairment of participants with sleep disorders was significantly higher than that of participants without.

Table 5 shows the adjusted means examining the effect of having sleep symptoms on QoL scores after controlling for clinical characteristics. The adjusted PCS, MCS, EQ-5D of the participants with any sleep disorders were lower than those of the participants without and adjusted overall activity impairment of participants with

Table 1 Clinical and sociodemographic profile of study participants

	N = 342
Age (years)	63.25 (10.21)
Male	82.5% (282)
Marital status	
Married/living with partner	74.9% (256)
Divorced/separated/widowed	25.1% (86)
Education	
University degree	46.5% (159)
All others	53.5% (183)
Household income	
< 3,000,000 JPY	17.0% (58)
3,000,000 to < 5,000,000 JPY	28.1% (96)
5,000,000 to < 8,000,000 JPY	24.0% (82)
8,000,000 JPY or more	18.7% (64)
Decline to answer	12.3% (42)
Insurance	
National health insurance	57.0% (195)
Social insurance	30.7% (105)
Late stage elderly insurance	8.8% (30)
Other/No insurance	3.5% (12)
Worker	46.2% (158)
Charlson comorbidity index	0.45 (0.91)
Smoking status	
Current smoker	26.3% (90)
Former smoker	38.9% (133)
Never smoker	34.8% (119)
Currently exercisers	55.0% (188)
Alcohol drinker	69.3% (237)
BMI category	
Underweight (< 18.5)	4.1% (14)
Normal weight (18.5 to < 25)	55.3% (189)
Overweight (25 to < 30)	27.2% (93)
Obese (≥ 30)	11.1% (38)
Decline to answer	2.3% (8)
Taking steps to lose weight	35.4% (121)
Duration of type 2 diabetes (years)	13.54 (10.59)
HbA1c level	
HbA1c < 7	37.1% (127)
HbA1c ≥ 7	41.8% (143)
Don't know/Decline to answer	21.1% (72)
Use of injectable medications	15.5% (53)
Ever experienced hypoglycemia	
Experienced hypoglycemia	27.8% (95)
Not experienced hypoglycemia	63.5% (217)

Table 1 Clinical and sociodemographic profile of study participants (Continued)

	N = 342
Do not know	8.8% (30)

Continuous variables are expressed as mean (SD) and categorical variables are expressed as % (number)

sleep disorders was significantly higher than that of participants without. This result was the same for the symptoms of waking up to go to the bathroom and daytime sleepiness. On the other hand, there was no difference in the adjusted means PCS, MCS, and overall activity impairment between participants with and without the symptom of waking up too early.

Discussion

This cross-sectional study showed the association between sleep disorders or specific sleep symptoms and QoL in patients with T2D. It revealed that 66.4% people with T2D suffer from sleep symptoms and that their QoL, including HRQoL and overall activity impairment, was worse than those of respondents without symptoms. This finding correlates with the results of previous studies [6–10, 27]. Also, this study revealed that waking up to go to the bathroom and daytime sleepiness are associated with worse QoL in people with T2D. Because to maintain and improve the QoL of people with diabetes is important goal, it should be recognized that the patients may have sleep disorders, especially the specific sleep symptoms discussed here.

Sleep disorders affect sleep quantity and quality. Sleep quantity is connected to the risk of lifestyle-related

Table 2 The prevalence of sleep symptoms

	N = 342
Experience any sleep symptoms	66.4% (227)
Difficulty falling asleep	12.6% (43)
Waking during the night and not being	12.3% (42)
Waking up several times during the night able to get back to sleep	13.2% (45)
Waking up too early (such as before the alarm clock)	20.2% (69)
Sleep apnea (temporary absence of breathing)	9.1% (31)
Leg cramps/leg problems	9.9% (34)
Waking up to go to the bathroom	35.4% (121)
Night sweats/hot flashes	5.8% (20)
Pain	0.9% (3)
Poor quality of sleep	12.0% (41)
Daytime sleepiness	27.8% (95)
Difficulty staying awake	2.3% (8)
Other	4.1% (14)

The data were expressed as % (number)

Table 3 Clinical and sociodemographic profile according to the experience of any sleep symptoms

	Any sleep symptoms (-) (n = 115)	Any sleep symptoms (+) (n = 227)	p-value
Age (years)	63.6 (9.61)	63.08 (10.52)	0.66
Male	81.7% (94)	82.8% (188)	0.804
Marital status			0.068
Married/living with partner	80.9 (93)	71.8% (163)	
Divorced/separated/widowed	19.1% (22)	28.2% (64)	
Education			0.306
University degree	42.6% (49)	48.5% (110)	
All others	57.4% (66)	51.5% (117)	
Household income			0.018
< 3,000,000JPY	18.3% (21)	16.3% (37)	
3,000,000 to < 5,000,000 JPY	21.7% (25)	31.3% (71)	
5,000,000 to < 8,000,000 JPY	24.3% (28)	23.8% (54)	
8,000,000 JPY or more	15.7% (18)	20.3% (46)	
Decline to answer	20.0% (23)	8.4% (19)	
Insurance			0.813
National health insurance	59.1% (68)	55.9% (127)	
Social insurance	27.8% (32)	32.2% (73)	
Late stage elderly insurance	8.7% (10)	8.8% (20)	
Other/No insurance	4.3% (5)	3.1% (7)	
Worker	40.0% (46)	49.3% (112)	0.102
Charlson comorbidity index	0.27 (0.61)	0.55 (1.01)	0.008
Smoking status			0.007
Current smoker	22.6% (26)	28.2% (64)	
Former smoker	31.3% (36)	42.7% (97)	
Never smoker	46.1% (53)	29.1% (66)	
Currently exerciser	55.7% (64)	54.6% (124)	0.857
Alcohol drinker	65.2% (75)	71.4% (162)	0.244
BMI category			0.131
Underweight (< 18.5)	6.1% (7)	3.1% (7)	
Normal weight (18.5 to < 25)	60.9% (70)	52.4% (119)	
Overweight (25 to < 30)	20.9% (24)	30.4% (69)	
Obese (≥30)	8.7% (10)	12.3% (28)	
Decline to answer	3.5% (4)	1.8% (4)	
Taking steps to lose weight	28.7% (33)	38.8% (88)	0.066
Duration of T2DM (years)	13.83 (10.63)	13.39 (10.59)	0.721
HbA1c level			0.008
HbA1c < 7	34.8% (40)	38.3% (87)	
HbA1c ≥7	34.8% (40)	45.4% (103)	
Don't know/Decline to answer	30.4% (35)	16.3% (37)	
Use of injectable medications	11.3% (13)	17.6% (40)	0.127
Ever experienced hypoglycemia			0.001
Experienced hypoglycemia	14.8% (17)	34.4% (78)	
Not experienced hypoglycemia	74.8% (86)	57.7% (131)	
Do not know	10.4% (12)	7.9% (18)	

Continuous variables were expressed as mean (SD) and categorical variables were expressed as % (number). T-test was used for continuous variables, and Chi-square test was used for categorical variable

Table 4 QoL scores according to the experience of any sleep symptoms

	All (n = 342)	Any sleep symptoms (-) (n = 115)	Any sleep symptoms (+) (n = 227)	p-value
QoL score				
PCS	48.71 (7.40)	50.59 (6.71)	47.76 (7.56)	< 0.001
MCS	48.15 (10.59)	51.90 (8.36)	46.25 (11.10)	< 0.001
EQ-5D	0.79 (0.17)	0.86 (0.15)	0.76 (0.18)	< 0.001
Overall activity impairment, %	26.23 (26.42)	18.52 (22.53)	30.13 (27.42)	< 0.001

QoL quality of life, PCS Physical component summary, MCS Mental Component Summary, EQ-5D EuroQol 5 Dimension. Continuous variables were expressed as mean (SD). T-test was used for continuous variables

diseases, such as diabetes [28] and nonalcoholic fatty liver disease [29]. Also, sleep quantity affects QoL; a survey of more than 200,000 people in the United States with chronic illnesses has confirmed that the U-shape relationship between sleep time and the prevalence of decreased HRQoL, suggesting that decrease in sleep time leads to a decline in HRQoL [30]. This relationship has been observed similarly in other countries in people with various diseases [31–34]. Relatedly, sleep quality is also an important matter, and one of the problems of sleep quality is sleep fragmentation. Sleep fragmentation leads to metabolic disorders through activating autonomic sympathetic nerves [35]. The activation of autonomic

sympathetic nerves leads to cardiovascular disease through changes in hemodynamics, vasoconstriction, and blood coagulation status [36]. Sleep fragmentation is also associated with psychological symptoms, such as depression [37]. Furthermore, the frequency of sleep disturbance is closely linked with the severity of self-reported symptoms in healthy individuals [38].

In this study, waking up to go to the bathroom is associated with poor QoL, including PCS, MCS, EQ-5D, and overall activity impairment, whereas waking up too early (such as before the alarm clock) is not associated with poor QoL, including PCS, MCS, and overall activity impairment. These results might be because of the difference

Table 5 Adjusted means examining the effect of having sleep symptoms on QoL scores after controlling for clinical characteristics

Sleep symptoms	Health outcomes	Adjusted mean (95% CI)	Adjusted mean (95% CI)	p-value
Any sleep symptoms		No (n = 115)	Yes (n = 227)	
	PCS	50.14 (48.86–51.41)	47.99 (47.10–48.88)	0.009
	MCS	51.32 (49.56–53.08)	46.54 (45.31–47.76)	< 0.001
	EQ-5D	0.84 (0.81–0.87)	0.77 (0.75–0.79)	< 0.001
	Overall activity impairment, %	18.87 (15.16–23.48)	27.26 (23.46–31.68)	0.009
Waking up to go to the bathroom		No (n = 221)	Yes (n = 121)	
	PCS	49.67 (48.78–50.57)	46.96 (45.73–48.19)	< 0.001
	MCS	49.29 (48.03–50.54)	46.06 (44.33–47.79)	0.004
	EQ-5D	0.81 (0.79–0.84)	0.76 (0.73–0.78)	0.002
	Overall activity impairment, %	20.73 (17.81–24.14)	31.24 (25.35–38.5)	0.003
Daytime sleepiness		No (n = 247)	Yes (n = 95)	
	PCS	49.21 (48.36–50.06)	47.41 (45.99–48.83)	0.038
	MCS	49.51 (48.34–50.68)	44.6 (42.64–46.55)	< 0.001
	EQ-5D	0.82 (0.80–0.84)	0.73 (0.70–0.77)	< 0.001
	Overall activity impairment, %	22.30 (19.39–25.64)	29.92 (23.73–37.71)	0.038
Waking up too early (such as before the alarm clock)		No (n = 273)	Yes (n = 69)	
	PCS	48.94 (48.14–49.75)	47.8 (46.13–49.46)	0.233
	MCS	48.51 (47.39–49.64)	46.7 (44.37–49.03)	0.178
	EQ-5D	0.80 (0.79–0.82)	0.75 (0.71–0.79)	0.02
	Overall activity impairment, %	23.83 (20.88–27.19)	26.58 (20.19–34.99)	0.493

QoL quality of life, PCS Physical component summary, MCS Mental Component Summary, EQ-5D EuroQol 5 Dimension. The QoL scores of the presence or absence of specific sleep symptoms were compared by multivariable analysis adjusting for age, sex, marital status, level of education, Charlson comorbidity index, smoking status, alcohol use, BMI category, taking steps to lose weight, duration of diabetes, HbA1c level, use of injectable medications and experience of hypoglycemia.

We selected specific sleep symptoms of waking up to go to the bathroom, daytime sleepiness and waking up too early (such as before the alarm clock) for multivariable analysis, because prevalence rates of these symptoms were over 20%

in the type of sleep disorder. Because of the interruption of sleep, sleep fragmentation occurs when waking up to go to the bathroom. Waking up to go to the bathroom has close association with nocturia. Many people with T2DM are suffered from nocturia [39]. Many risk factors, including male sex, hypertension, high B-type natriuretic peptide level, low vegetable intake and early bedtime are reported [39, 40]. Dietary education [41] and medication intervention might be useful to reduce these risk factors. On the other hand, a decrease in sleep time occurs when waking up too early (such as before the alarm clock). Previous studies revealed that the effect of sleep fragmentation on mental and physical health is more severe than that of sleep quantity [42, 43].

This study also revealed that daytime sleepiness is associated with poor QoL. This correlates with studies that show that elderly people with hypertension and daytime sleepiness have a reduced QoL [44]. The decline of sleep quantity, which reduces the performance of higher cognitive processes, [45] might cause HRQoL to decline through daytime sleepiness.

This study has some limitations. Data from the NHWS are self-reported and did not include medical records or physician's reports, and so no verification of diagnoses can be conducted. Moreover, the representativeness of each subsample is unknown. However, these data have been used in various publications, including data of T2D [46, 47]. Causal relationships between sleep symptoms and health outcomes cannot be assumed. The Japan NHWS 2016 had been completed when we started to analyze it. Therefore, the sample size was not predefined.

Conclusion

In this study, about two-thirds of the people with T2D suffered from sleep disorders, and there is a relationship between sleep-related symptoms, especially waking up to go to the bathroom and daytime sleepiness, and HRQoL or labor productivity. It is, therefore, important to focus on sleep disorders, especially on symptoms of waking up to go to the bathroom or daytime sleepiness, in order to maintain and improve QoL of people with diabetes. Further studies focusing on sleep symptoms are needed for improvement QoL of people with diabetes.

Abbreviations

QoL: Quality of life; T2D: Type 2 diabetes; NHWS: National Health and Wellness Survey; HRQoL: Health-related QoL; PCS: Physical component summary; MCS: Mental component summary; EQ-D: EuroQoL 5 Dimension; LSR: Lightspeed Research; BMI: Body mass index; CCI: Charlson comorbidity index; SF-36: 36-Item short-form; WPAI: Work Productivity and Activity Impairment

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Authors' contributions

Y.H. designed the study, interpretation data and wrote manuscript, R.S. designed the study and contributed to discussion. K.I. designed the study, interpretation data and wrote manuscript. M.F. designed the study and revised the discussion. All authors approved the final version of the manuscript, and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Availability of data and materials

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

Ethics approval and consent to participate

The survey was conducted with approval from Pearl IRB (IRB Study Number: 16-KAN-124). Written informed consent was obtained from all participants. The authors were granted access to NHWS data from Kantar Health for this research.

Consent for publication

Not applicable.

Competing interests

K.I. is an employee of Kowa Pharma Co. Ltd., M.F. received research supports and honorarium from Kowa Pharma Co. Ltd. In addition, Y.H. received honoraria from Mitsubishi Tanabe Pharma Corp, and Novo Nordisk Pharma Ltd., and M.F. received grants from Takeda Pharma Co. Ltd., Sanofi K.K., Kissei Pharma Co. Ltd., Mitsubishi Tanabe Pharma Corp, Astellas Pharma Inc., Nippon Boehringer Ingelheim Co. Ltd., Daiichi Sankyo Co. Ltd., MSD K.K., Sanwa Kagaku Kenkyusho Co., Ltd., Kowa Pharma Co. Ltd., Kyowa Kirin Co., Ltd., Sumitomo Dainippon Pharma Co. Ltd., Novo Nordisk Pharma Ltd., Ono Pharma Co. Ltd., Eli Lilly Japan K.K., Taisho Pharma Co., Ltd., Teijin Pharma Ltd., Nippon Chemiphar Co., Ltd., Johnson & Johnson K.K. Medical Co., Abbott Japan Co. Ltd., and Terumo Corp., and received honoraria from Teijin Pharma Ltd., Arkray Inc., Kissei Pharma Co., Ltd., Novo Nordisk Pharma Ltd., Mitsubishi Tanabe Pharma Corp., Sanofi K.K., Takeda Pharma Co. Ltd., Astellas Pharma Inc., MSD K.K., Kyowa Kirin Co. Ltd., Sumitomo Dainippon Pharma Co. Ltd., Daiichi Sankyo Co. Ltd., Ono Pharma Co. Ltd., Sanwa Kagaku Kenkyusho Co. Ltd., Nippon Boehringer Ingelheim Co., Ltd., Taisho Pharma Co., Ltd., Bayer Yakuhin, Ltd., AstraZeneca K.K., Mochida Pharma Co. Ltd., Abbott Japan Co. Ltd., Eli Lilly Japan K.K., Medtronic Japan Co. Ltd., and Nipro Corp. outside the submitted work. R.S. has no potential conflict of interest.

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Association Between Quality of Sleep and Health-Related Quality of Life in Persons with Diabetes Mellitus Type 2

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Abstract

Aim and objectives. To estimate the relationship of sleep quality with health-related quality of life (HRQOL) in persons with diabetes mellitus type 2 (DMT2) living in the United Arab Emirates (UAE).

Background. DMT2 is an epidemic health condition in the UAE that has enormous impacts on health, and consequent effects on HRQOL. However, because of an absence of screening for quality of sleep, people with DMT2 who experience poor sleep are likely to go untreated, which may compound the distressing impacts of DMT2 on their HRQOL.

Design: This is a cross-sectional quantitative research design.

Methods. A sample of 268 participants with DMT2 were recruited from community healthcare settings in the UAE using cluster sampling. Participants completed questionnaires, including the Pittsburgh Sleep Quality Index (PSQI) and the World Health Organization-HRQOL. Data analysis used descriptive and correlational statistics.

Results. Of the 268 participants, 34% identified as “poor sleepers” and 55% had poor HRQOL. Poor sleepers showed significantly lower scores for HRQOL than good sleepers. The global PSQI scores were found to be independently predictive of global HRQOL. Subjective perceptions of sleep quality, the use of sleep medications, and impaired daytime functioning were the variables found to have the highest correlations with global HRQOL and its four domains.

Conclusions. This study found that people with DMT2 who indicate experiencing poor-quality sleep are more likely to show a negative correlation with HRQOL. Additional research is needed to investigate how poor sleep may impact the health of people with DMT2.

Relevance to clinical practice. Findings suggest that assessment of sleep quality should be an essential component of diabetes care. Understanding sleep practices may aid public health practitioners and other healthcare providers in the design of culturally-appropriate interventions to improve sleep quality in persons with DMT2.

Keywords: Diabetes mellitus Type 2, sleep quality, daytime dysfunction, use of sleep medication, subjective sleep quality, health-related quality of life.

What does this paper contribute to the wider global clinical community?

- Poor sleep is a common concern among people with diabetes mellitus type 2 (DMT2), and has an influence on their health related quality of life (HRQOL), yet it is rarely recognized or assessed by healthcare providers.
- This paper provides a current understanding of sleep quality and its correlation with HRQOL, utilizing data from a population with DMT2 in the UAE.
- Public health practitioners treating patients with DMT2 should address sleep issues in general practice, with assessment as a fundamental aspect of routine diabetes care. Nurses have a frontline role in assessing and integrating culturally-appropriate sleep education programs and interventions that might improve the quality of sleep in people affected by DMT2.
- Recognizing the sleep-diabetes association is crucial for improving health at a population level.

Introduction

Diabetes mellitus type 2 (DMT2) has become a major public health concern with incidence rates rising globally at an alarming rate. The global prevalence of the disease in adults over 18 years of age is expected to double, from 4.3% in 2010 to a projected 8.5% in 2030 (Sicree *et al.* 2015). A recent study that analyzed data from 751 population-based studies, encompassing more than four million adults from 146 countries, reported a marked increase in the prevalence of diabetes (NCD Risk Factor Collaboration 2016). The study found that since 1980, the number of adults with diabetes has quadrupled worldwide, and is rising more steeply in developing countries.

Diabetes is a challenging disease that adversely affects sufferers' HRQOL that requires their adjusting to necessary changes in diet and lifestyle, regular monitoring of glucose levels, the development of chronic complications, and the presence of other co-morbid conditions as they age (Bani-Issa 2011, Kuznetsov *et al.* 2015, Sparring *et al.* 2013, The Look Ahead Research Group 2014, Wändell 2005). A vast body of literature is agreed on the adverse impact of diabetes on the HRQOL of subjects. Health-related quality of life is identified as a powerful predictor of treatment outcomes, as well as a person's capacity to manage the disease and retain their long-term health and well-being (Rubin & Peyrot, 1999). Persons with diabetes who report a low HRQOL have increased morbidity and overall mortality rates (Sullivan & Hushchyan 2016, Siersma *et al.*, 2014). In patients (enrolled in the European Study Group on Diabetes and the Lower Extremity study) presenting with new diabetic foot ulcers, poor HRQOL was found to be predictive of poor prognosis, major amputation, and death in subjects (Siersma *et al.* 2014).

Quality of sleep plays a vital role in metabolic health; sleep impairment has been found to place healthy people at risk for development of DMT2 due to its impact on insulin resistance (Barone & Menna-Barreto 2011). Poor sleep also adversely affects the HRQOL of persons with diabetes (Lou *et al.* 2015). One study estimated that a third of diabetes sufferers experience sleep problems, compared to only 8.2% of a non-diabetic control group (Sridhar & Madhu 1994). Persons with DMT2 report sleep problems such as falling and staying asleep, sleep apnea, restless leg syndrome, painful neuropathy, daytime fatigue, and frequent urination at night (Lou *et al.* 2015, Luyster and Dunbar-Jacob 2011, Lecube *et al.* 2016, Plantinga, *et al.* 2012, Lou *et al.* 2012, Tang *et al.* 2014). Recent studies have reported that more than half of the DMT2-affected populations are at risk for one or more manifestations of difficulty with sleep (Cass *et al.* 2013, Stogaard *et al.* 2014).

Luyster and Dunbar-Jacob (2011) examined the association between sleep quality (assessed using Pittsburgh Sleep Quality Index) and HRQOL, and found that people with poor sleep quality (PSQI ≥ 5) had significantly lower scores for HRQOL (assessed using SF-36 Mental Component Summary and sub-scores for social functioning, emotional role, and mental health). Similar findings were reported in another study of patients with DMT2 ($n = 124$) who had comorbid restless leg syndrome (RLS) (Merlino *et al.* 2010). Results indicated that RLS was a risk factor for lower scores on global mental component and vitality scores (Merlino *et al.* 2010). Lou *et al.* (2015) found poor sleep to be inversely correlated with HRQOL in a study from China of adults with DMT2, especially among those who had a longer duration, and complications of the disease.

However, because of the low incidence of screening for sleep quality in community healthcare settings where diabetes care is provided, the majority of people with DMT2 who experience this condition may go untreated, resulting in more distressing impacts on their HRQOL (Lou *et al.* 2015, Luyster & Dunbar-Jacob, 2011).

The United Arab Emirates (UAE) is a country that is undergoing rapid epidemiological transition with DMT2 being identified as a major health concern; in 2015, more than one million cases were reported in the country (Sicree *et al.* 2015). To date, no studies that address sleep quality and its relation to HRQOL for people living with DMT2 in the UAE have been undertaken. Given the high incidence of this disease among the UAE population, it is vital that sleep quality is routinely assessed to inhibit its adverse effects on the HRQOL of people with DMT2. Therefore, this study attempted to assess sleep quality and estimate its correlation with the HRQOL in a DMT2 population in the UAE.

Methods

Study design

The current study uses a quantitative, cross-sectional, correlational design in a cluster sampling approach, in which 500 people from randomly selected community healthcare settings were invited to participate.

Setting

The UAE is a country located on the Arabian Peninsula, comprising of seven emirates (cities). Of these, Dubai has the largest population, followed consecutively by Abu Dhabi, Sharjah, Ajman, Ras Al-Khaimah, Al Fujairah and Um Al Quwain. These centers provide family and community-oriented care through health screening, health promotion and day-to-day management of minor and chronic diseases.

Researchers utilized one-stage cluster sampling technique to access subjects with DMT2. For each Emirate, the researchers formed a cluster of all Ministry of Health and Promotion-operated community healthcare centers located in both rural and urban areas for participation in the study. Cluster sampling is appropriate for heterogeneous populations, and where little

information about the subjects is available, as was the case in our study (Shackman 2001).

From the seven clusters, researchers used simple random sampling to select five community healthcare settings from each cluster to achieve a representative sample. Only twelve community healthcare settings consented to be part of the study, including three from Sharjah, two from Ajman, two from Dubai and one from Ras Al Khaimah, two in Abu Dhabi, one from Um Quwain, and one from Al-Fujairah.

Recruitment and study population

Recruitment was conducted with the assistance of nurse practitioners at the study sites.

Research assistants (RAs) met with potential participants at the sites to describe the study.

Once individuals agreed to participate, their consent was obtained and they were given instructions for completing the questionnaires/instruments and depositing them in a locked box at each study site for later collection by the research team.

Inclusion criteria stipulated that participants should be aged between 20 and 60 years old, have been diagnosed with DMT2 for a minimum of one year, as confirmed by medical records and the practitioners at the site, and have the ability to communicate in Arabic or English. Both Emirati and expatriate men and women were invited to participate. To be eligible, participants must have had a recent value for glycated hemoglobin (HbA1C) (%) that was attributed one month before the date of data collection. Pregnant women and people who had experienced a recent major traumatic event were excluded from the study, since such conditions may independently affect sleep and quality of life. The sample size was pre-determined using OpenEpi (Open Source Epidemiologic Statistics for Public Health (OpenEpi)/USA-version 2.3.1) for cross-sectional studies (Dean *et al.* 2016), with HRQOL as the main outcome variable. Sample size was estimated based on an anticipated prevalence rate of poor HRQOL of 50% (as no data were available on prevalence rates of poor HRQOL

in adults with DMT2), 95% confidence interval (CI), design effect (DEFF) of 1.0, and .05 significance level (p value). In addition, the researchers took into account similar cross-sectional research studies that had investigated sleep quality and quality of life in adults with DMT2 (Luyster & Dunbar-Jacob 2011). Therefore, a minimum of 500 subjects with DMT2 were sought over a six month period.

Ethical approval was obtained from Research Ethics Committee at the principal investigator's institution. Consent forms and demographic information were kept in a locked cabinet inside the principal investigator's office. Individual questionnaires were coded, and personal identifiers removed.

Instruments

Quality of Sleep

Participants' quality of sleep was assessed using the Pittsburgh Sleep Quality Index (PSQI) (Buysse *et al.* 1989). This index is an efficient tool for assessing the quality and pattern of sleep in adults during the past month. The scale evaluates seven aspects of sleep: quality, latency, duration, efficiency, disturbances, use of sleep medication, and daytime dysfunction, each scored from 0 to 3. A global PSQI score ranges from 0 to 21, higher scores indicating poorer or impaired sleep quality, and a score of 5 or greater has been found to have a sensitivity of 89.6% and specificity of 86.5% in differentiating good from poor sleepers (Buysse *et al.* 1989, Skomro 2008).

The tool has been used to assess sleep in persons with DMT2 and reported to have adequate psychometric properties (Lou *et al.* 2015, Luyster & Dunbar-Jacob 2011, Tang *et al.* 2014). The Arabic version of the PSQI was used to enable Arabic speaking subjects to participate in this study. The scale has been tested and used in Arabic-speaking adult

populations and found to be sensitive, acceptable and have good psychometric properties (Suleiman *et al.* 2010).

Health-related quality of life

The World Health Organization Quality of Life (WHOQOL-BREF) questionnaire was used in the current study to assess the HRQOL of subjects. The WHOQOL-BREF is a self-report 26 item questionnaire to measure four domains of HRQOL, namely, physical (seven items), psychological (six items), social relationships (three items), and environment (eight items), and two items which measure overall health-related life quality. Respondents rated the intensity, frequency, or evaluation of the selected attributes of HRQOL during the previous two weeks on a 5-point Likert-type response scale. The mean score of items in each domain was used to calculate the domain score, and finally, they were transformed to a 0 - 100-scale with higher scores indicate higher levels of HRQOL (World Health Organization 1996). A score of ≥ 60 was used as a cut-off point to differentiate “poor” and “good” HRQOL (Silva *et al.* 2014). The Arabic version of the WHOQOL-BREF, which has been found to be acceptable by participants and demonstrated good internally consistent reliabilities indexes (Bani-Issa 2011, Eljedi *et al.* 2006), was used to assess HRQOL in Arabic-speaking participants.

Other variables

Age, sex, education status, income and nationality of participants, years of diagnosis with DMT2, and presence of at least one comorbid condition along with diabetes were recorded by the researcher. Diagnosis of DMT2 was confirmed with nurse practitioners and participants' medical charts. The number of complications from DMT2 was assessed by participants'

reports of being diagnosed with at least one complication of diabetes, including coronary artery disease, peripheral vascular disease, stroke, nephropathy, retinopathy, or neuropathy.

Statistical analysis

Statistical analysis was executed using SAS® Studio 3.5 (SAS Institute, Cary, USA). Means, standard deviations, frequencies and percentages were used to describe the study's variables. The T-test and the Chi-squared test were used to compare differences in the continuous and categorical variables, respectively. Logistic regression analysis was conducted to examine the association between sleep quality (a score of ≥ 5 indicating poor quality) and HRQOL (dependent variable with score of ≥ 60 indicating good HRQOL), by adjusting for confounders including age, marital status, employment status, nationality, education, household income, HbA1C, diabetes-related complications, diabetes accompanied comorbidities, gender, and duration of diabetes. Variables that were not significantly correlated to global HRQOL were deleted from the regression model. The odds ratios (OR) and 95% confidence intervals (CI) were determined for all variables. All tests were two-tailed and the level of significance was set at P values of $\leq .05$. Pearson correlation coefficients with level of significance set at P values of ≤ 0.05 were used to add detail to information about the nature of the correlations between global HRQOL and its four subdomains (physical, psychological, social relationships, and environment) to PSQI and its seven components (quality, latency, duration, efficiency, disturbances, use of sleep medication, and daytime dysfunction domains).

Results

Out of 500 participants invited to participate in the study, 318 (63.6%) met the study's inclusion criteria and agreed to participate in the study. Major reasons for declining to participate included lack of time and/or lack of interest in the study. Fifty subjects were excluded because there was no current values of HbA1C available in their charts. Around 62% of participants were females with almost two-thirds of participants (75%) were married and 56.3% were UAE nationals. The mean age of participants was 42.4 (SD= 12.5); 58.3% of the sample were educated to high school level and above; and 74.2% reported having an average income.

As to the general health status of participants, 56.3% did not report having any comorbid or pre-existing health conditions along with diabetes. Two-thirds (72.7%) of the participants reported having at least one diabetes-related complication, and a quarter having had diabetes for more than 11 years; the mean of HbA1C values was 7.93 (SD = 1.43). The general characteristics of the participants are presented in Table 1.

Global Quality of Sleep

The mean global PSQI score in participants was 6.17 ± 3.22 . As shown in Table 1, a total of 90 participants (34%) were poor sleepers ($PSQI \geq 5$). Participants between the ages of 41 to 50 years reported poorer sleep quality than those in other age categories, ($p < .002$). Of poor sleepers, 27.7% had a high school diploma, and 25.5% a college/university degree education. Participants with an average household income (74.2%) were found to be poor sleepers compared to others ($p = .02$). Participants with at least one complication of DM2 reported poor sleep (84%) compared to their counterparts without complications $p < .00$. No significant differences between poor and good sleepers were found by gender, marital status, nationality, presence of co-morbidities, or HbA1C values.

Global Health Related Quality of Life

The mean score (average) of the global WHOQOL-BREF for participants was 58.7 ± 13.3 . Table 2 shows that overall, about 55% of participants reported poor HRQOL (total score < 60). Participants aged from 41 to 50 years old, and UAE nationals had poorer HRQOL than non-nationals, p values $< .005$. Similarly, those who had high school or higher levels of education, and had an average household income, demonstrated poorer HRQOL compared to other participants in the group.

Participants with comorbidities accompanying diabetes had poor HRQOL ($p = .01$) compared to those without a comorbid condition. A significant number of participants with diabetes-related complications had poorer HRQOL (80.9%) ($p < .000$) compared to those without complications. Also, participants with a duration of diabetes longer than 10 years had poorer quality of life compared to others. Global scores of HRQOL did not differ significantly across other variables, including gender, marital status and HbA1C status.

Sleep quality and health related quality of life

Results of multivariate logistic regression on the association between global PSQI and global HRQOL (dependent variable) are presented in Table 3. After removing variables that were not significantly related to HRQOL (HbA1C and marital status), and adjusting for confounders (complications of diabetes, income, presence of co-morbidities, age, nationalities, education, education, gender, duration of diabetes), the global PSQI was found to be a strong independent predictor of global HRQOL (OR=8.20, 95% CI: 4.34-15.45, $p < .001$).

Table 4 shows the detailed bivariate correlations between mean scores for global and the seven sleep components of the PSQI to global and four sub-domains of HRQOL. Subjective sleep quality, followed by use of sleep medications, daytime dysfunction, and sleep disturbance were all significantly correlated with global HRQOL and its four dimensions – physical, psychological, social relationship and environment. A lower correlation, although still statistically significant, was noted between sleep latency and global and four sub- domains of HRQOL. The most significant correlation was seen between subjective sleep quality with the global and the four dimensions of the HRQOL (correlations ranged from -0.3 for environment to -0.6 for physical domain).

Discussion

The findings of this study represent significant additional evidence for the strong independent correlation between the quality of sleep for persons living with DMT2 and their HRQOL in the UAE.

It is the first research study to have evaluated the sleep quality of people with DMT2 living in the UAE, and to have assessed its correlation with an important health indicator, namely HRQOL. Using validated measures, this study found that poor sleep is common in patients with DMT2 which is consistent with findings from previous studies (Lou *et al.* 2015, Luyster & Dunbar-Jacob 2011, Lecube 2016, Plantinga *et al.* 2012, Lou *et al.*

2012, Storgaard *et al.* 2014, Skomro 2008). While the finding for prevalence was somewhat similar to those reported in some cross-sectional studies, of 34% (n=994 patients) and 35% (n= 46 patients), the figure was lower than has been reported in other studies, where more than half of the respective samples were poor sleepers (n= 300) (Luyster & Dunbar-Jacob, 2011, Skomro 2008, Skomro *et al.* 2001, Tsai *et al.* 2012).

Poor sleepers in our sample had higher education, an average income, were in the middle age category, and had at least one diabetes-related complication. Similarly to other studies, poor sleep was reported by participants who were aged 40 years or more, and had complications related to diabetes (Luyster & Dunbar-Jacob 2011, Lou *et al.* 2012). It is important to note that the prevalence of poor sleep experience in our study might have been higher had the sample included greater numbers of people from other age categories, since around 44% of our sample were middle-aged (41-50 years old). Therefore, because other age sub-groups were under-represented in this study, these results should be interpreted with caution. Given the sensitivity of sleep quality to age, it is recommended that future studies include sufficient numbers of each age group within their sample populations (Bani-Issa 2011).

It was expected that the duration of diabetes diagnosis would be a predictor of poor sleep, as reported by other studies (Lou *et al.* 2012). In our relatively younger sample, shorter diabetes only 25% had had diabetes for more than more ten years), yet, surprisingly, notwithstanding the majority's shorter duration of clinical diagnosis of diabetes, a large number of participants (72%) reported having at least one complication of the disease. It may be possible that many participants had undiagnosed diabetes for a significant period of time prior to confirmation by a clinician. This highlights the importance of screening for diabetes early to maximize the benefits of treatment options for the disease (Herman *et al.*

2015). Although the UAE has initiated several health programs across the country to raise awareness of the risks and symptoms of diabetes, better public informational campaigns are needed to facilitate the early detection of DMT2.

Importantly, the results from this study demonstrated that poor sleepers show significantly worse HRQOL according to measures of physical, psychological, social relationship and environmental well-being, reflecting those of other studies (Chasens *et al.* 2014, Herman *et al.* 2015, Lou *et al.* 2015, Lou *et al.* 2012, Luyster & Dunbar-Jacob 2011, Merlino *et al.* 2010, Skomro 2008, Tang *et al.* 2014). These findings also indicate the importance of routine screening of DMT2 patients for sleep quality by healthcare practitioners in community healthcare settings. It has been suggested that unrecognized and untreated sleep disorders in persons with diabetes affect daily life functioning in several ways (Chasens *et al.* 2014, Chasens & Luyster, 2016).

Screening and assessment of sleep quality should include healthy adults, since poor sleep has also been reported as a contributing factor to development of DMT2. Recently, a systematic review and meta-analysis found that sleep disturbances of both short (<6 h) and long (>8 h) sleeping duration, and abnormal sleep timing have been associated with increased risk for diabetes risk, particularly for those who are overweight or obese (Anothaisintawee 2016). Therefore, it is recommended that GPs working in community healthcare settings integrate sleep assessment and awareness into their daily practice procedures to reduce the likelihood of currently healthy adults developing DMT2.

In the UAE, with a majority Muslim population, general practitioners and diabetes educators need to be aware of the perceptions and practices of Muslims regarding sleep and sleep habits. For example, mandatory religious practices such as waking up early every day for the first prayer (*Fajr*), at dawn or about one hour before sunrise, and performing the last prayer (*Isha*) in the evening, about 1.5-2 hours after sunset, need to be considered (BaHammam 2011). Other practices like the short midday nap (called *Qailulah* in Islamic culture), encouraging sleeping on the right side and discouraging sleeping in the prone

position are deeply embedded in the Muslim culture. Since the majority of healthcare providers in the UAE are expatriates, a better understanding of cultural ideas and practices of sleep is crucial among diabetes educators and GPs.

This study also contributes new information about the components of sleep that have the highest correlation with HRQOL in persons with DMT2 in the UAE. Subjective sleep quality was found to have the highest correlations with all dimensions of HRQOL and to be an independent predictor of overall HRQOL. Numerous studies have found that subjective sleep quality is an important component of sleep and a predictor of HRQOL (Lou *et al.* 2015, Chasens *et al.* 2014, Chasens & Luyster 2016). Most available epidemiological studies focus mainly on the incidence of sleep apnea in diabetes patients (Lou *et al.* 2015, Luyster & Dunbar-Jacob 2011, Grimaldi *et al.* 2014), and there is scope for future studies to assess other aspects of disordered sleep; most important is the subjectivity of sleep experience because it is based on the sleepers' perceptions (Maglione *et al.* 2014). GPs can integrate into treatment a sleep diary for patients with DMT2 to provide a subjective measure of sleep quality, in addition to standardized assessments such as the PSQI. GPs are also advised to utilize other objective sleep measures, such as wrist actigraphy, to ascertain sleep quality over a one week period. Recent studies reported an association between results from wrist actigraph-assessed sleep measurement and glucose hemostasis (Kim *et al.* 2016). Therefore, GPs and diabetes educators are best-placed to influence clinical practice regarding screening of sleep quality to assist in the prevention of its impact on health and well-being in persons with DMT2.

These recommendations arising from the study align with those of the American Diabetes Association's (ADA) Standards of Care (2017) which consider assessment of sleep patterns to be part of a comprehensive medical evaluation based on emerging evidence that suggests a link between sleep quality, physical and mental health and glycemic control

(Maglione *et al.* 2014, Kim *et al.* 2016, ADA 2017). Interventions to identify and provide treatment referrals for co-existing sleep disorders are needed to improve the sleep patterns of poor sleepers, and to enable more effective self-management of diabetes (ADA 2017).

Adopting a more holistic, patient-centered approach is crucial to positive treatment outcomes in diabetes management (Anderson & Funnell 2000). The creation of individualized treatment plans that consider variations between patients would provide individuals with the necessary skills to manage their disease-related challenges (*ibid.*). As previously stated, the cultural sleep practices should be taken into account when tailoring individualized sleep hygiene programs for persons with DMT2.

Conclusion

The results of our study have shown that persons with DMT2 commonly report poor sleep quality, which could be a currently neglected barrier to promote better HRQOL (Chasens *et al.* 2014, Herman *et al.* 2015, Lou *et al.* 2015, Lou *et al.* 2012, Luyster & Dunbar-Jacob 2011, Merlino *et al.* 2010, Skomro 2008, Tang *et al.* 2014). The statement of the International Diabetes Federation (2017) and ADA (2017) on the need to assess sleep quality as part of routine diabetes care (Shaw *et al.* 2008) is supported by the clinical implications of this study.

General practitioners, mainly nurses, working with people living with DMT2 in the UAE must also understand the perceptions and sleep practices of Muslims to provide culturally appropriate care for this population. Nurses and GPs can play a vital role providing and maintaining current knowledge about sleep hygiene to promote better HRQOL for people with the disease. This knowledge can be extended to healthy persons given extant evidence that poor sleep quality may lead to increased insulin resistance, and ultimately to the development of DMT2 (Anothaisintawee 2016, Chasens *et al.* 2014, Chasens & Luyster

2016, Grimaldi *et al.* 2014, Institute of Medicine 2006, Kim *et al.* 2016, Maglione *et al.* 2014, Nedeltcheva & Scheer 2014).

The cross-sectional nature of this study, and its reliance on the self-reporting of sleep quality, together with the less than expected response rate (63%) limit the generalizability of results. Therefore, further research that seeks to better understand the link between sleep patterns and HRQOL, and to influence the treatment outcomes for people with DMT2 in terms of the health aspects of their quality of life, is necessary. Given the complex relationship of influences between sleep, HRQOL and diabetes, longitudinal and intervention studies might be the best approach to gaining deeper insight into this associative complexity so that focused interventions can be crafted.

Relevance for clinical practice

Findings from the current study are valuable for public health practitioners and other healthcare providers because they serve to increase their awareness about the significance of addressing sleep issues in persons with DMT2. Assessment of the sleep patterns of this population needs to be an integral part of daily clinical practice, along with other physiological assessments. Insight into sleep practices and habits may aid in designing culturally-appropriate interventions to improve sleep quality in persons with diabetes. Further, nurses' involvement in advising persons with diabetes about good sleep hygiene practices, aspects of lifestyle, and cognitive and behavioral modifications that may improve their sleep quality will be facilitated.

Importantly, given the evidence of the association between disturbed sleep and the risk for development of DMT2, the study suggests that nurses are in the best position to assess sleep problem in healthy persons as a means of preempting the risk of insulin resistance, a precursor for development of DMT2. Sleep awareness campaigns can assist in raising public

awareness of the importance of regularizing good sleep as a component of better metabolic health with the aim of reducing the risk of the onset of diabetes.

Furthermore, the correlation between sleep, T2DM and HRQOL is not straightforward, and the mechanism by which sleep quality is related to the development of diabetes is not well delineated. Therefore, more research that explores the saliency of this association is recommended. Future research should also control for the extraneous variables that this study did not, which include obesity, family history, and lifestyle factors, to comprehend in greater depth the multidimensional nature of the association between sleep, diabetes, and HRQOL.

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Contributions

WBI: Study design; data collection and analysis; and manuscript preparation. WBI, AA, LP: Study design; data analysis; and manuscript preparation. WBI, AA: Study design; and data analysis. WBI, AA, LP: Manuscript preparation.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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Table 1 The distribution of general characteristics of participants by Pittsburgh Sleep Quality Index Score (PSQI) (n = 268)

Variables	All (n=268)	Sleep Quality		°p
		Good (< 5)	Poor (≥ 5)	
All (n=268)		178 (66%)	90 (34%)	
Gender				0.104 ^a
Male	102 (38.0%)	67 (37.6%)	35 (38%)	
Female	166 (61.9%)	111 (62.4%)	55 (62%)	
Age (years) (M = 42.4, SD= 12.5)				0.002 ^a
20-30	21 (7.8%)	15 (8.4%)	6 (6.7%)	
31-40	58 (21.6%)	38 (21.3%)	20 (22.2%)	
41-50	118 (44%)	81 (45.5%)	37 (41.1%)	
51+	71 (26.4 %)	44 (24.7%)	27 (30%)	
Marital status				0.113 ^a
Married	202 (75%)	133 (74.7%)	69 (76.7%)	
Single	66 (24.6%)	45 (25.2%)	21 (23.3%)	
Nationality				0.072 ^a
Local	151 (56.3%)	97 (54.4%)	54 (60%)	
Non-Local	117 (43.6%)	81 (45.5%)	36 (40%)	
Education				<.000 ^a
Not educated	39 (14.6%)	26 (14.6%)	13 (14.4%)	
Primary	36 (13.4%)	21 (11.8%)	15 (16.7%)	
Middle School	37 (13.8 %)	23 (12.9%)	14 (15.6%)	
High School	80 (29.9%)	55 (30.9%)	25 (27.7%)	
College Degree	76 (28.4%)	53 (29.8%)	23 (25.6%)	
Income				0.02 ^a
Below	27 (10.0%)	18 (10.1%)	9 (10%)	
Average	199 (74.2%)	134 (75.2%)	65 (72.2%)	
Above	42 (15.6%)	26 (14.6%)	16 (17.8%)	

Duration of Diabetes				0.069 ^a
0-10 years	200 (74.9%)	129 (72.9%)	71 (78.9%)	
11 or more years	67 (25.1%)	48 (27.1%)	19 (21.1%)	
Presence of comorbidity	117 (43.7%)	80 (44.9%)	37 (41.1%)	0.087 ^a
Presence of diabetes related	195 (72.7%)	119 (66.9%)	76 (84%)	<.000 ^a

Complication

HbA1C (%)	7.93(±1.43)	7.92(±1.42)	7.96(±1.50)	0.829 ^b
HRQOL global score	58.7(±13.3)	61.9(±13.2)	52.5(±11.2)	<.000 ^b

Note. ^a Based on results of Chi-square statistics. ^b Based on results of t-test. ^c = $p \leq .05$

Table 2 The distribution of general characteristics of participants by Health Related Quality of Life (HRQOL) (n = 268)

Variables	All (n=268)	HRQOL		^c p
		Good (≥ 60)	Poor (< 60)	
All (n=268)		121 (45%)	147 (54.9%)	
Gender				0.06 ^a
Male	102(38.0%)	50 (41.3%)	52 (35.4%)	
Female	166 (61.9%)	71 (58.7%)	95 (64.6%)	
Age (years) (M = 42.4, SD= 12.5)				.000 ^a
20-30	21 (7.8%)	11 (9%)	10 (6.8%)	
31-40	58 (21.6%)	24 (19.8%)	34 (23.2%)	
41-50	118 (44%)	48 (39.7%)	70 (47.6%)	
51+	71 (26.4 %)	38 (31.4%)	33 (22.4%)	
Marital status				.100 ^a
Married	202 (75%)	93 (76.9%)	109 (74.1%)	
Single	66 (24.6%)	28 (23.1%)	38 (25.9%)	
Nationality				.004 ^a
Local	151 (56.3%)	58 (47.9%)	93(63%)	
Non-Local	117 (43.6%)	63 (52.1%)	54 (36.7%)	
Education				<.000 ^a
Not educated	39 (14.6%)	16 (13.2%)	23 (15.6%)	
Primary	36 (13.4%)	13 (10.7%)	23 (15.6%)	
Middle School	37 (13.8 %)	12 (9.9%)	25 (17.0%)	

High School	80 (29.9%)	37 (30.6%)	43 (29.2%)	
College Degree	76 (28.4%)	43 (35.5%)	33 (22.4%)	
Income				.005 ^a
Below	27 (10.0%)	8 (6.6%)	19 (12.9%)	

Average	199 (74.2%)	92 (76%)	107 (72.8%)	
Above	42 (15.6%)	21 (17.4%)	21 (14.2%)	
Duration of Diabetes				0.009 ^a
0-10 years	200 (74.2%)	82 (68%)	118 (80.3%)	
11 or more years	67 (25.1%)	38 (31.7%)	29 (19.7%)	
Presence of comorbidity	117 (43.7%)	52 (43%)	65 (44.2%)	0.01 ^a
Presence of diabetes related complications	195 (72.7%)	76 (62.8%)	119 (80.9%)	.000 ^a
HbA1C (%)	7.93(± 1.43)	8.11(± 1.6)	7.80(± 1.28)	.200 ^b
PSQI	6.17(±3.22)	4.70(± 2.90)	7.40(± 2.90)	<.000 ^b

Note. ^a Based on results of Chi-square test statistics. ^b Based on results of t-test statistics. ^c = $p \leq .05$

Table 3 Logistic regression analysis for sleep quality and health- related quality of life (HRQOL)^a (n = 268)

Variables	B	S.E.	OR	95%CI	^b p
Quality of Sleep	2.10	0.33	8.20	4.34-15.45	<.001
Presence of diabetes related complications	-0.44	0.36	0.64	0.32-1.31	0.222
Income (average)	-1.44	0.58	0.24	0.08-0.74	0.013
Presence of comorbidities	-0.03	0.35	0.97	0.49-1.92	0.932
Age	-0.02	0.02	0.98	0.95-1.01	0.216
Nationality (non-local)	-0.74	0.35	0.57	0.28-1.16	0.035
Education (intermediate)	0.70	0.52	2.10	0.73-6.03	0.178
Gender (female)	0.31	0.33	1.30	0.67-2.52	0.347
Duration of diabetes	0.72	0.38	2.05	0.97-4.34	0.490

^a = Dependent variable. ^b = p value is significant at $p \leq .05$

Table 4 Relationship between global score and the seven component scores of ^a PSQI and global score and the four domains scores of ^b HRQOL with Person correlation analysis (r) (n = 268)

Dimensions	Physiology	Psychology	Social	Environment	Global HRQOL score
Subjective sleep quality	-0.599*	-0.419*	-0.315*	-0.271*	-0.484*
Sleep latency	-0.244*	-0.245*	-0.157*	-0.160*	-0.242*
Sleep duration	0.090	0.0288	0.034	0.004	0.0485
Habitual sleep efficiency	-0.007	-0.051	-0.040	0.051	-0.014
Sleep disturbances	-0.348*	-0.308*	-0.180*	-0.189*	-0.308*
Use of sleep medications	-0.502*	-0.292*	-0.257*	-0.208*	-0.381*
Daytime dysfunction	-0.409*	-0.290*	-0.247*	-0.265*	-0.364*
Global PSQI score	-0.510*	-0.388*	-0.292*	-0.259*	-0.437*

^a = Pittsburgh Sleep Quality Index Score. ^b = Health Related Quality of Life (HRQOL). * = p value is significant at $p \leq .05$



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Original Article

Health-related quality of life and sleep quality among North Indian type 2 diabetes mellitus patients: evidence from a cross-sectional study

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abstract

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Objective: The objective of this study is to measure the relationship between sleep quality and health-related quality of life (HRQoL), in Indian population with type 2 diabetes mellitus (T2DM).

Methods: A cross-sectional study, included a total of 300 patients with T2DM. All participants were responding to the Pittsburgh Sleep Quality Index (PSQI) and European Quality of Life-5 Dimensions Questionnaire (EQ-5D). A PSQI global score ≤ 5 was defined as poor sleep quality. EQ-5D visual analogue scale (VAS), determining the overall health status. Logistic regression analysis was used to examine the association between PSQI and EQ-5D. All the study data were analysed using the SPSS software version

20.0. Values of $p < 0.05$ were considered statistically significant.

Results: The mean age of included participants were 55.29. Majority of the participants (55.3%) were identified as "poor sleepers" and female (31.3%) contributing higher proportion. Poor sleepers had significantly lower the HRQoL ($p < 0.001$). After adjustment, poor sleep quality was significantly asso-

ciated with a lower HRQoL; EQ-5D index (OR $\frac{1}{4}$ 1.080, 95% CI: 1.015–1.148, $p < 0.05$), and EQ-5D VAS

(OR $\frac{1}{4}$ 1.092, 95% CI: 1.021–1.176, $p < 0.01$). Overall, the EQ-5D index and EQ-5D VAS were found to be an independent predictors of sleep quality.

Conclusions: Poor sleep quality is prevalent in Indian T2DM population, and it imparts negative impact on several dimensions of EQ-5D that characterising the daily activities performance. Therefore, further real-world studies are needed to determine the causal relationship between T2DM patients and measure of objective sleep and their impact on health.

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1. Introduction

Diabetes is a metabolic disorder, remains a substantial socio-economic and humanistic burden worldwide [1]. According to International Federation of Diabetes (IDF), the estimated number of populations with diabetes mellitus is more than 425 million, and it may predict to increase up to 629 million by 2045. The epidemiology is rising markedly in the people who live in low-and middle-income countries. South-East Asia and Western Pacific regions have become the epicentre of the diabetes crisis while India accounted for a total

of 74 million of persons with diabetes reside in India [2].

Type 2 diabetes mellitus (T2DM) has negative impact on health-related quality of life (HRQoL), and health outcomes [3,4]. A growing body of literature is agreed on the negative impact of diabetes on the HRQoL, and it is characterized as an important predictor of treatment outcomes, it may have increased morbidity and all cause of mortality [5–7]. T2DM patients are more likely to have sleep disturbance compared with the healthy population [8].

Several studies also have shown poor sleep sharing common feature of T2DM [9,11] with age- and sex-matched controls [12] and its impairs the QoL in T2DM patients [13,15].

Globally sleep deprivation has become more prevalent over the recent years, and associated with the significant burden of T2DM. In respect of World Sleep Day 2019, Philips conducted its annual sleep survey across 12 countries including India on more than 1,000 adults to capture attitudes, perceptions, and behaviour towards sleep. The results revealed that about 73% of Indian adults want to improve their sleep quality [16].

Sleep disorder plays an important role in diabetes incidence through neurometabolic pathway [17,18]. A potential mechanism showed impaired sleep increases cortisol level, that may inhibit insulin production or reduce insulin sensitivity followed by increased blood glucose levels that leads to development of pre-diabetes or diabetes [19].

The prevalence of poor sleep quality was found to be higher (69%) among Indian T2DM population [20]. A cross-sectional study reported that people with poor sleeper had significantly lower scores for HRQoL [13,21]. The study suggested short or long sleep duration and poor sleep quality makes detrimental effect on HRQoL as well. Moreover, understanding and determinants of HRQL and sleep hygiene among individual with T2DM would be important to adapt and target health care resources to improve the health outcomes for the T2DM. It is also more important for evidence-based practice to help clinician to address the sleep hygiene in person with T2DM.

However, to date the relationship between HRQoL and sleep quality has not been reported in the Indian T2DM population. Therefore, the objective of this study to conducted a cross-sectional study to measure the sleep quality and estimate its association with the HRQoL in Indian T2DM patients.

2. Methods

2.1. Study design

The cross-sectional study was conducted between May 2018 and September 2019 in out-patient department of medicine, at Hakeem Abdul Hameed Centenary (HAHC) Hospital, Hamdard Institute of Medical Sciences & Research (HIMSR), Jamia Hamdard, New Delhi, India. The study protocol was approved by Jamia Hamdard Institutional Ethics Committee (JHIEC), New Delhi, India. This study was carried out in full compliance with the Declaration of Helsinki [22] (Brazil, October, 2013) and written in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for reporting a cross-sectional study [23]. Written informed consent was obtained from all of the participants voluntarily. All participants were assured of their confidentiality and the anonymity of their identity.

2.2. Study population

Patient selection was carried out on the basis of pre-defined inclusion and exclusion criteria.

Only participants that meeting all the following criteria were included in the study: (a) willingness to participate in the study by providing signed informed consent form; (b) patients aged 18 years or above of either sex; (c) patients who had confirmed diagnosis of T2DM as per their medical records or having FPG (fasting plasma glucose) level 126 mg/dl.

In our study, we excluded subjects who were pregnant, on antihypertensive medication, or suffering from any cardiovascular disease, stroke, neuropathy, psychosis, depression, chronic obstructive pulmonary disease, obstructive sleep apnoea

syndrome, prediabetes, and any other diseases. Participants are also excluded who had missing information on sleep duration or sleep quality.

Demographic characteristics such as age, gender, education marital status, and life style (smoking, drinking), and family history were recorded in the case record form. We used modified Kuppuswamy's socioeconomic scale to assess the economic status of the patients. According to this scale, socioeconomic status was categorised into five subscales (upper, upper middle, lower middle, upper lower, and lower) on the basis of education, occupation of head of family, and monthly income of family.

3. Outcome measures

3.1. Sleep quality

Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI). PSQI is a self-rating scale developed by Buysse et al. [24], assesses quality of sleep during the past month and it contains seven component scales; sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component of score ranged from 0 to 3. The sum of the scores for the seven-component obtaining a global PSQI score ranging from 0 to 21. The higher PSQI global score, indicating worse sleep quality. Patients were categorized into two groups according to PSQI: Poor sleep quality (PSQI ≥ 5) and good-sleep quality (PSQI < 5) [24]. A global PSQI score ≤ 5 has been found to have a sensitivity of 89.6% and specificity of 86.5% in differentiating good sleepers vs. poor sleepers [24].

3.2. Health-related quality of life

The European Quality of Life-5 Dimensions questionnaire (EQ-5D) consists of two parts, the first part is a health status categorised in five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each perspective has five alternatives ie, "no problems", "slight problems", "moderate problems", "severe problems", and "extreme problems" or unable to (mobility, self-care and usual activities), which scores from 1 (no problem) to 5 (extreme problems).

Responses to the first part of the EQ-5D can be noted separately for each individual item in terms of a profile (EQ-5D profile) or converted into a weighted index (EQ-5D index) using EQ-5D-5L Crosswalk Index Value Calculator downloaded from the EuroQol website [25]. The score of EQ-5D index ranges from 0.111 to 1, where 1 represents preferred health.

The second part of the EQ-5D is visual analogue scale (VAS), determining the overall health status. It consists of a 20 cm scale to measure the participant's perception of his or her Quality of life (QoL) or good or bad health on the day of the interview. This scale ranged from 0 to 100, 0 represents worst health you can imagine while 100 represents best health.

3.3. Statistical analysis

All Continuous variables were expressed as mean standard deviation (SD), and categorical variables are expressed as percentages and frequencies. Student's t-test and the chi square (χ^2) test were used to test the significant differences in the continuous and categorical variables, respectively. AVONA test was used to compare the differences among groups.

Spearman's rank correlation coefficients (rs) was performed to measure the relationship between QoL and sleep quality.

Logistic regression models were used to investigate the association between PSQI global score, EQ5D index, VAS and other variables, including age, sex, BMI, HbA1c, and duration of diabetes.

Bivariate logistic regression analysis was conducted to test the associations of sleep quality (PSQI) and quality of life (EQ-5D index and EQ-5D VAS scores). The calculated odds ratios (OR) and 95% confidence intervals (CI) were determined the association for all variables.

All the study data were analysed using the Statistical Package for Social Sciences; SPSS software version 20.0 for Windows (SPSS Inc., Chicago, IL, USA). Values of $p < 0.05$ were considered statistically significant.

4. Results

4.1. Socio-demographic characteristics of included participants

A total of 300 patients were participated in this study on the basis of predefined inclusion and exclusion criteria (Fig. 1). The male group contributing higher percentage (50.7%), with overall mean age of included participants was 55.29 ± 12.45 years.

Updating for January 2017 Modified Kuppuswamy scale, the socioeconomic status of the most of the participants were contributed upper middle class (47.7%), lower middle (25.3%), upper lower (14.0%), upper (12.7%), and only 0.3% for lower class. Additionally, most of the participants were self-funded (88.0%), 8.7% had reimbursement and the remaining 0.3% was insured.

Overall, 55.3% of the subjects reported poor sleep quality, while 44.7% reported good sleep quality. The prevalence of poorer sleep among female population was significantly higher compared to male (31.3% vs. 24.0%, $p < 0.005$). However, the prevalence of good sleep quality among male population was found to be significantly higher 26.7% as compared to female 18% (26.7% vs. 18.0%, $p < 0.005$). The detailed characteristics of included participants were depicted in Table 1.

4.2. Sleep quality and health-related quality of life

In Table 2. The mean FPG and PP shown significantly higher among poor sleep quality groups compared to good sleep quality (167.08 ± 61.61 vs. 154.68 ± 61.34 and 247.99 ± 83.16 vs. 226 ± 77.04 , all $p < 0.05$).

Participants had a mean duration of diabetes (7.40 ± 6.75) years since T2DM had been diagnosed. Sleep duration (7.26 ± 1.15 vs. 5.97 ± 1.46) and sleep efficiency (93.26 ± 9.90 vs. 82.57 ± 15.12) was observed significantly higher in those with good sleep quality than poor sleep quality ($p < 0.001$), but sleep latency was shown significantly higher among poor sleep quality group compared to good sleep quality (38.84 ± 40.57 vs. 11.57 ± 9.02 ($p < 0.001$)). Overall, the mean global PSQI score was 6.02 ± 4.03 , the significant differences were found between good sleep quality and poor sleep quality (2.58 ± 1.24 vs. 8.79 ± 3.30 , $p < 0.001$). There is only a dimension from EQ-5D (pain discomfort) was found significantly

higher among poor sleepers when compare to good sleepers (1.83 ± 1.00 vs. 1.59 ± 0.85 , $p < 0.05$). However, no significant differences were detected between good sleep quality and poor sleep quality corresponding to any other dimensions of EQ-5D and any other parameters.

Furthermore, the overall mean of EQ-5D index and EQ-5D VAS scores were 0.79 ± 0.22 and 77.50 ± 23.42 respectively. The mean of EQ-5D index scores and EQ-5D VAS scores were reported higher among good sleep quality group as compared to poor sleep quality (0.82 ± 0.21 vs. 0.76 ± 0.24 , $p < 0.05$) and EQ-5D VAS scores (80.27 ± 23.56 vs. 74.72 ± 23.26 , $p < 0.05$), and it has been detected significant.

4.3. Pearson's correlation analysis

Relationship between EQ-5D dimensions, EQ-5D VAS and PSQI domains were presented in Table 3. The scores for EQ-5D dimensions such as, mobility, self-care, and usual activities showed

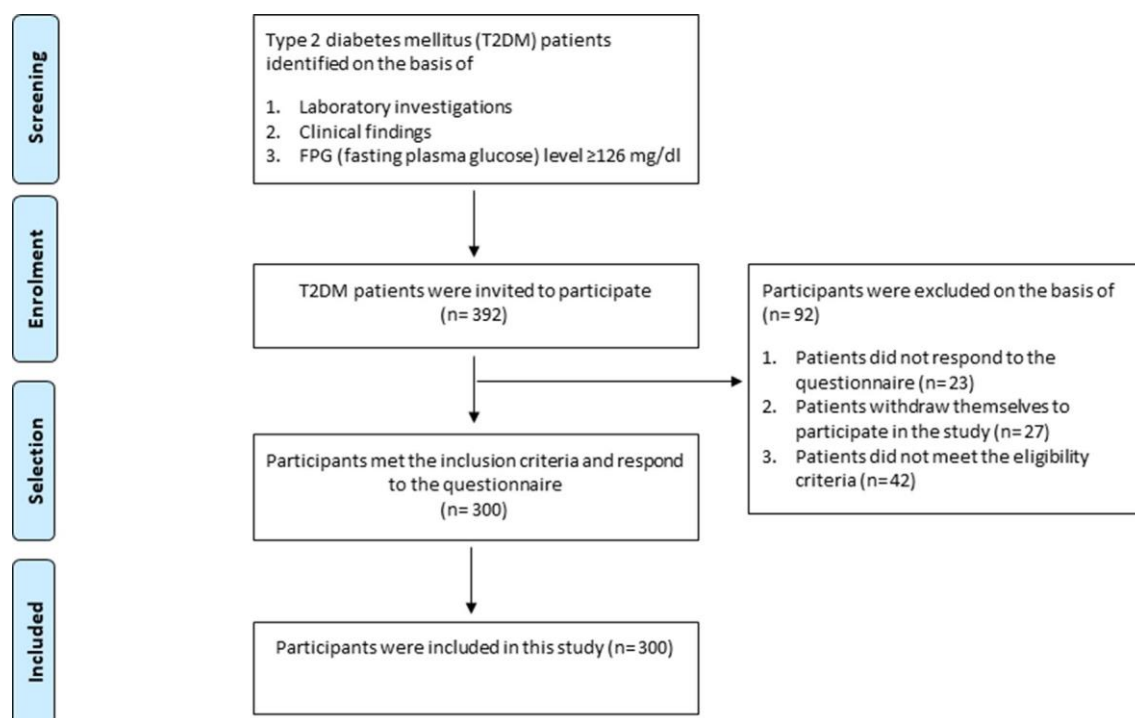


Fig. 1. Flow diagram showing participants selection process.

Table 1

Sociodemographic characteristics of included participants.

n, %	All 300	Sleep quality		p value
		Good 134 (44.7)	Poor 166 (55.3)	
Gender (n,%)				
Male	152 (50.7)	80 (26.7)	72 (24.0)	0.005**
Female	148 (49.3)	54 (18.0)	94 (31.3)	
Age; years (mean $\pm$ SD)	55.29 $\pm$ 12.45			
Male	57.29 $\pm$ 12.10			0.000 1**
Female	53.18 $\pm$ 12.51			
Marital status (n,%)				
Married	287 (95.7)	128 (42.7)	159 (53.0)	0.623
Unmarried	1 (0.3)	0 (0.0)	1 (0.3)	
Widow	12 (4.0)	6 (2.0)	6 (2.0)	
Funding (n,%)				
Insurance	10 (3.3)	3 (1.0)	6 (2.0)	0.706
Reimbursement	26 (8.7)	11 (3.7)	15 (5.0)	
Self	264 (88.0)	120 (40.0)	145 (48.3)	
Smoking (n,%)				
Frequently	10 (3.3)	5 (1.7)	5 (1.7)	0.706
Moderate	1 (0.3)	1 (0.3)	0	
Occasionally	2 (0.7)	1 (0.3)	1 (0.3)	
None	287 (95.7)	127 (42.3)	160 (53.3)	
Tobacco (n,%)				
Frequently	9 (3.0)	2 (0.7)	6 (2.0)	0.364
Moderate	8 (2.7)	5 (1.7)	3 (1.0)	
Occasionally	1 (0.3)	1 (0.3)	1 (0.3)	
None	282 (94.0)	126 (42.0)	156 (52.0)	
Alcohol (n,%)				
Frequently	6 (2.0)	3 (1.0)	3 (1.0)	0.935
Moderate	4 (1.3)	2 (0.7)	2 (0.7)	
Occasionally	6 (2.0)	2 (0.7)	4 (1.3)	
None	284 (94.7)	127 (42.3)	157 (52.3)	
Family history of DM (n,%)				
Yes	100 (33.3)	43 (14.3)	48 (16.0)	0.395
No	190 (63.3)	88 (29.3)	104 (34.7)	
Unknown	10 (3.3)	3 (1.0)	14 (4.6)	
Education (n,%)				
Honors	3 (1.0)	1 (0.3)	2 (0.7)	0.159
Graduate or post grad	37 (12.3)	21 (7.0)	16 (5.3)	
Intermediate	48 (16.0)	27 (27.0)	21 (7.0)	
High school	49 (16.3)	20 (6.7)	29 (9.7)	
Middle school	11 (3.7)	5 (1.7)	6 (2.0)	
Primary	49 (16.3)	14 (4.7)	35 (11.7)	
Literate	76 (25.3)	33 (11.0)	43 (14.3)	
Illiterate	27 (9.0)	13 (4.3)	14 (4.7)	
Socioeconomic (n,%)				
Upper	38 (12.7)	17 (5.7)	21 (7.0)	0.788
Upper middle	143 (47.7)	66 (22.0)	77 (25.7)	
Upper lower	42 (14.0)	17 (5.7)	25 (8.3)	
Lower middle	76 (25.3)	33 (11.0)	43 (14.3)	
Lower	1 (0.3)	1 (0.3)	0	

SD: standard deviation; DM: diabetes

mellitus. Statistical Significance at **p < 0.01.

positive significant correlation with sleep disturbance ($r = 0.164$, $p < 0.01$) ($r = 0.133$, $p < 0.01$) ($r = 0.130$, $p < 0.05$), daytime dysfunction ($r = 0.155$, $p < 0.01$) ($r = 0.163$, $p < 0.01$) ($r = 0.135$, $p < 0.05$), global PSQI ($r = 0.129$, $p < 0.05$) ($r = 0.117$, $p < 0.05$) ($r = 0.118$, $p < 0.05$) respectively. Similarly, pain/discomfort also positively correlated with subjective sleep quality ($r = 0.171$, $p < 0.01$), sleep latency ($r = 0.140$, $p < 0.05$), sleep disturbance ($r = 0.140$, $p < 0.05$), daytime dysfunction ($r = 0.167$, $p < 0.01$), and global PSQI ($r = 0.162$, $p < 0.01$). Whereas, EQ-5D VAS showed inverse correlation with subjective sleep quality ($r = 0.149$, $p < 0.05$), sleep disturbance ($r = -0.111$, $p < 0.05$), daytime dysfunction ($r = -0.119$, $p < 0.05$), and global PSQI ($r = -0.128$, $p < 0.05$). Similarly, EQ-5D Index was also have shown negative correlation with sleep disturbance ($r = 0.130$, $p < 0.05$), daytime dysfunction ($r = 0.133$, $p < 0.05$), and global PSQI ($r = 0.122$, $p < 0.05$). Furthermore, EQ-5D VAS have shown inverse correlation with all dimensions for EQ-5D ($p < 0.01$) (Table 4).

Positive correlation was found between, poor sleep quality and dimensions for EQ-5D, especially with regard to mobility ($r = 0.180$, $p < 0.05$), self-care ($r = 0.168$, $p < 0.05$) and usual activities ($r = 0.163$, $p < 0.05$). However, poor sleep quality have shown negative association with EQ-5D index ($r = -0.174$, $p = 0.024$) and EQ-5D VAS ($r = -0.158$, $p = 0.042$) (Table 5).

4.4 Logistic regression analysis

Bivariate logistic regression performed to find out the association between sleep quality (dependent variable) and HRQoL, are presented in Table 6. Sleep quality was significantly associated with EQ-5D index (OR = 1.080, 95% CI: 1.015–1.148, $p < 0.05$), and EQ-5D VAS (OR = 1.092, 95% CI: 1.021–1.176, $p < 0.01$), after adjusting for various confounders. Overall, the EQ-5D index and EQ-5D VAS were found to be an independent predictors of sleep quality.

Table 2

Anthropometric measurements and other biochemical parameters of included participants.

	All (n = 300) mean ± SD	Sleep quality		p value
		Good (134) mean ± SD	Poor (166) mean ± SD	
Age (years)	55.29 ± 12.45	56.88 ± 12.59	53.66 ± 12.24	0.026*
Height (cm)	168.55 ± 95.97	170.36 ± 99.76	166.92 ± 92.85	0.794
Weight (kg)	47.66 ± 31.61	50.93 ± 30.84	45.03 ± 32.06	0.108
BMI (kg/m ²)	25.93 ± 5.04 161.54 ±	25.65 ± 4.95 153.68 ± 61.34	26.15 ± 5.12 168.08 ± 61.61	0.391 0.043*
FPG (mg/dl) PP (mg/dl)	61.70 238.26 ± 81.08 8.40 ± 2.21	226 ± 77.04 8.20 ± 2.25	247.99 ± 83.16 8.56 ± 2.17	0.021* 0.168
HbA1c (%)				
Duration of T2DM (years)	7.40 ± 6.75	7.49 ± 6.63	7.31 ± 6.86	0.840
Subjective sleep quality (C1)	1.06 ± 0.85	0.47 ± 0.51	1.54 ± 0.76	0.000* *
Sleep latency (C2) Sleep	1.03 ± 1.03 1.23 ± 0.91	0.38 ± 0.51 0.76 ± 0.71	1.56 ± 1.05 1.60 ± 0.88	0.000* *
duration (C3)	0.69 ± 1.07	0.14 ± 0.53	1.13 ± 1.18	0.000* *
Sleep efficiency (C4) Sleep	0.97 ± 0.74 0.37 ± 0.95	0.64 ± 0.70 0.02 ± 0.27	1.23 ± 0.66 0.64 ± 1.19	0.000* *
disturbance (C5)	0.62 ± 0.74	0.14 ± 0.39	1.01 ± 0.73	0.000* *
Use of sleeping medication (C6) Daytime dysfunction (C7)	6.02 ± 4.03	2.58 ± 1.24	8.79 ± 3.30	0.000* *
Global PSQI				0.000* *
Sleep Duration (hrs) Sleep	6.54 ± 1.47 87.35 ± 14.07	7.26 ± 1.15 93.26 ± 9.90	5.97 ± 1.46 82.57 ± 15.12	0.000* *
Efficiency (%)	26.66 ± 33.60	11.57 ± 9.02	38.84 ± 40.57	0.000* *
Sleep Latency (min)	1.80 ± 1.04	1.75 ± 1.00	1.84 ± 1.07	0.000* *
Mobility Self-care				0.432 0.697
Usual activities	1.36 ± 0.80 1.39 ± 0.81	1.34 ± 0.71 1.37 ± 0.76	1.37 ± 0.86 1.40 ± 0.85	0.700 0.032*
Pain/discom fort	1.72 ± 0.94 1.59 ± 0.85	1.59 ± 0.85 1.55 ± 0.81	1.83 ± 1.00 1.62 ± 0.87	0.500
Anxiety/depression EQ-5D Index				
EQ-5D VAS	0.79 ± 0.22 77.50 ± 23.42	0.82 ± 0.21 80.27 ± 23.56	0.76 ± 0.24 74.72 ± 23.26	0.026* 0.042*

BMI: body mass index; FPG: Fasting plasma glucose; PP: postprandial glucose; HbA1c: Glycated Haemoglobin T2DM: type 2 diabetes mellitus; PSQI: Pittsburgh Sleep Quality Index; EQ-5D: European Quality of Life-5 Dimensions questionnaire; EQ-5D VAS: Euro Quality of Life -visual analogue scales.

Statistical Significance at **p < 0.01, *p < 0.05.

Table 3

Relationship between EQ-5D dimensions, EQ-5D VAS and PSQI domains.

Domains r (p value)	Mobility	Self-care	Usual activities	Pain/discomfort	Anxiety/depression	EQ-
5D VAS (0.003)**	EQ-5D Index 0.045 (0.442)	Subjective sleep quality (C1) −0.149 (0.010)*	0.100 (0.084) −0.110 (0.058)	0.059 (0.306)	0.084 (0.144)	0.171
Sleep latency (C2)	0.074 (0.199)	0.052 (0.366)	0.046 (0.425)	0.140 (0.015)*	0.036 (0.538)	−0.097 (0.094) −0.095 (0.099)

Sleep duration (C3)	0.036 (0.532)	0.087 (0.134)	0.058 (0.317)	0.097 (0.095)	0.090 (0.121)	−0.072 (0.213)	−0.103 (0.074)
Sleep efficiency (C4)	0.066 (0.252)	0.052 (0.366)	0.104 (0.071)	0.099 (0.088)	−0.008 (0.894)	−0.054 (0.353)	−0.055 (0.346)
Sleep disturbance (C5) (0.045)* −0.130 (0.024)*	0.164 (0.004)**	0.153 (0.008)**	0.130 (0.025)*		0.140 (0.015)*	0.028 (0.626)	−0.111
Use of sleeping medication (C6)	0.032 (0.585)		−0.001 (0.980)	0.010 (0.862)	−0.058 (0.316)	−0.079 (0.172)	−0.002 (0.979)
		0.045 (0.441)					
Daytime dysfunction (C7) (0.039)* −0.133 (0.021)*	0.155 (0.007)**	0.163 (0.005)**	0.135 (0.019)*		0.167 (0.004)**	0.039 (0.500)	−0.119
Global PSQI (0.034)*	0.129 (0.025)*	0.117 (0.043)*	0.118 (0.041)*	0.162 (0.005) **	0.030 (0.609)	−0.128 (0.026)*	−0.122

EQ-5D: European Quality of Life-5 Dimensions questionnaire; EQ-5D VAS: Euro Quality of Life -visual analogue scales; PSQI: Pittsburgh Sleep Quality Index. *r*, correlation coefficient.

*, Statistically significant correlation ($p \leq 0.05$).

**, Statistically highly significant correlation ($p \leq 0.01$).

Table 4

Relationship between EQ-5D VAS and EQ-5D dimensions.

Dimensions	<i>r</i>	<i>p</i> value
Mobility	−0.673	0.0001**
Self-care	−0.686	0.0001**
Usual activities	−0.709	0.0001**
Pain/discomfort	−0.716	0.0001**
Anxiety/depression	−0.689	0.0001**

EQ-5D: European Quality of Life-5 Dimensions questionnaire; EQ-5D VAS: Euro Quality of Life -visual analogue.

r, correlation coefficient.

*, Statistically significant correlation ($p \leq 0.05$).

**, Statistically highly significant correlation ($p \leq 0.01$).

5. Discussion

As the increasing prevalence of poor sleep quality among Indian type 2 diabetic population [20], that may affect HRQoL. The

Table 5

Relationship between poor sleep and EQ-5D dimensions, EQ-5D index, EQ-5D VAS.

Dimensions	Poor sleep quality	
	<i>r</i>	<i>p</i> value
Mobility	0.180	0.020*
Self-care	0.168	0.031*
Usual activities	0.163	0.036*
Pain/discomfort	0.105	0.178
Anxiety/depression	0.020	0.795
EQ-5D Index	−0.174	0.024*
EQ-5D VAS	−0.158	0.042*

EQ-5D: European Quality of Life-5 Dimensions questionnaire; EQ-5D VAS: Euro Quality of Life -visual analogue.

r, correlation coefficient.

*, Statistically significant correlation ($p \leq 0.05$).

diabetes and sleep disturbance comorbidities are likely to poses substantial negative impact on individual's health.

Table 6

Logistic regression analysis for sleep quality and health related quality of life.

	OR	95% CI	p value
FPG	0.995	0.986–1.004	0.249
PP	1.006	1.000–1.013	0.040*
HbA1c	1.046	0.896–1.222	0.569
Duration of T2DM (years)	1.001	0.962–1.042	0.955
Mobility	0.809	0.481–1.360	0.423
Self-care	0.853	0.433–1.681	0.647
Usual Activities	0.854	0.425–1.713	0.656
Pain discomfort	1.878	0.990–3.563	0.044*
Anxiety Depression	0.910	0.475–1.746	0.777
EQ-5D index	1.080	1.015–1.148	0.014*
EQ-5D VAS	1.092	1.021–1.176	0.005*

OR: odds ratio; CI: confidence interval; FPG: fasting plasma glucose; PP: post-prandial glucose; HbA1c: Glycated Haemoglobin; EQ-5D: European Quality of Life-5 Dimensions questionnaire; EQ-5D VAS: Euro Quality of Life -visual analogue.

Sleep quality^{1/4} Dependent variable. Statistical Significance, **P < 0.01, *P < 0.05.

Adjustment for age, sex, marital status, source of funding, education level, family history of T2DM, socioeconomic status, BMI, smoking and alcohol drinking.

Therefore, the results of this study represented significant evidence on correlation between sleep quality and HRQoL for persons living with T2DM in the India. To the best of our knowledge, this is the first study conducted in India that examine the sleep quality and assessed relationship with HRQoL and their related functional outcomes in people with T2DM. This study found that poor sleeper is most prevalent (55.33%) in patients with T2DM, which is consistent with findings from several previous studies, of 69% (n 120) in India [20], 55% (n 300) in USA [13], 53.3% (n 110) in Brazil [26], and females had poor sleep quality [11,21].

Poor sleepers had significantly higher FPG, and PP levels, suggested worse glycaemic control. As overall poor sleep quality is a characteristic of sleep disturbance [27,28]. This finding in line with recent published systematic literature review included 26 studies that documented sleep disturbance is characterized by impaired sleep quality or altered sleep duration, and it results in impaired daytime functioning, altered glycaemic control, and quality of life [29]. We found higher mean of HbA1c levels among patients those who have poor sleep quality, but it was not significant comparing to good sleep quality. This finding consistent with the previous cross-sectional study [21]. Recent meta-analysis evident that poor sleep quality significantly associated with increased HbA1c levels [30]. It has been suggested that, a good sleep quality would reduce HbA1c levels and improve the glycaemic control.

Importantly, results from the current study suggested poor sleep quality in adults with T2DM contributing a negative impact on HRQoL. Similarly, a Chinese study documented that poor sleep is most prevalent and positively (OR: 3.67, 95% CI: 1.30–10.33, p < 0.001) associated with lowering HRQoL in persons with T2DM [21].

Additionally, our study also in agreement with numerous studies have found that dimensions of health functioning status such as physical, mental, psychological and daily activities are associated with sleep disturbance (poor sleep quality, extreme sleep duration, and short sleep duration), that may have detri-

mental impact on QoL [31–37]. Hence, the mechanism underlying sleep disturbance and its impact on HRQoL has been documented. Sleep impairment results into fatigue, which profoundly altered self-reported measure of well-being [38], and negative effect on neurobehavioral and physiological changes such as loss of attention, loss of interest in activities, reduced glucose tolerance, and activation of the sympathetic nervous system [39]. Collectively, these alterations may cause significant impairment in QoL.

The mean (SD) EQ-5D VAS score in our study was found to be 77.31 (23.42), which is consistent with the other studies which has been carried in Indian diabetic population with reported mean (78.83) [40] and 75.0 [41]. The EQ-5D VAS scores were ranges from (71.1–77.8) in low-income and middle-income countries (LMIC) [42–44]. In contrary to our findings, a study reported comparatively lower mean 74.5, in in three metropolitan cities of South Asia [45]. Lower mean score of EQ-5D VAS represents lowering HRQoL. Poor sleeper had lower mean score of EQ-5D VAS and EQ-5D index, which suggested that poor sleep quality may worsen the HRQoL among T2DM patients, and the findings are consistent with recent study [21].

Poor sleep quality was inversely correlated with total score of EQ-5D index, and EQ-5D VAS suggests poor sleepers can be predictor of lowering HRQoL. Likewise, a previous study conducted among T2DM patients in the United Arab Emirates, revealed that poor sleep quality showed a negative correlation with HRQoL [46]. Positive correlation between sleep quality and mobility, self-care, and usual activities, indicating EQ-5D may affect sleep quality. These results propose that poor sleep is common among individuals with T2DM and may adversely affect QoL.

Therefore, therapy to improve sleep disturbance could be suggested in diabetic individuals by healthcare practitioner must be a part of diabetes self-management education programs [13].

Based on the current evidence, further study needed to confirm the difference in EQ-5D VAS scores within the Indian population carrying same disease. Therapies are needed for co-existing sleep disorders to improve the sleep patterns of poor sleepers, and to assure the adequate and more effective self-management of diabetes [47].

5.1. Strength

This study provides evidence of EQ-5D index score that may be used in the cost utility analysis to reporting QALY and in assessment of cost effectiveness analysis or health economic evaluations. Consequently, these evidences are required for developing countries like India that may use by respective HTA bodies to informed policy and decision-making to ensure the adequate healthcare resources. Our study brings the consequences that sleep hygiene could be potential predictor of HRQoL among T2DM patients and vice versa. Therefore, a single treatment can be developed and implemented to improve their HRQoL as well as sleep quality.

5.2. Limitations

This study has several limitations. First, this is a cross-sectional approach, without a single follow-up, we could not estimate the causal relationship between sleep quality, duration and QoL. Second, in this study the sleep quality was subjectively assessed rather to objective assessment and the variable may be associated by the incidence of poor sleep quality was not objectively measured.

5.3. Relevance and implications in clinical practice

This evidence may help clinicians and healthcare professionals to identify and manage sleep disturbance among T2DM patients in a very efficient manner. A recommendation about sleep hygiene must be implicated in both clinical and community settings. The government health programme can assure the people with diabetes to access the efficient healthcare resources.

6. Conclusion

Findings of this study suggest that poor sleep quality is prevalent in Indian T2DM population, and imparts negative impact on HRQoL. Therefore, this study suggests that early screening and examination of sleep hygiene is required to ensure the management for improving their QoL among persons with T2DM.

Furthermore, a longitudinal study with long-term follow with more sample size are needed to determine the causal relationship between T2DM patients and measure of objective sleep.

Ethical approval

This protocol was reviewed and approved by Jamia Hamdard Institutional Ethics Committee (JHIEC), New Delhi, India.

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Clinical trial registration

Not applicable.

CRediT authorship contribution statement

Md Azharuddin: Conceptualization, Methodology, Software, Formal analysis, Investigation, Validation, Writing - original draft, Writing - review & editing, Visualization. **Prem Kapur:** Conceptualization, Methodology, Resources, Investigation, Visualization, Supervision. **Mohammad Adil:** Validation, Writing - review & editing, Visualization. **Pinaki Ghosh:** Writing - review & editing, Visualization. **Manju Sharma:** Conceptualization, Methodology, Formal analysis, Validation, Writing - review & editing, Visualization, Supervision.

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Conflict of interest

The authors declare no conflict of interests.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: <https://doi.org/10.1016/j.sleep.2020.04.022>.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.sleep.2020.04.022>.

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Quality of life and sleep in diabetes mellitus patients

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Abstract

Aim: As in other chronic diseases, symptom and signs of psychiatric disorders are more common in patients with diabetes mellitus (DM) than in the general population. The aim of this study was to evaluate the quality of life and sleep in DM patients.

Material and Methods: A total of 100 DM patients, 56 (56%) female and 44 (44%) male, were included in the study. Control group consisted of 100 healthy volunteers (53 females (53%) and 47 males (47%)). The sociodemographic and clinical characteristics of participants were recorded. Patients were asked to complete the 36-Item Short-Form Health Survey (SF-36) and Pittsburgh Sleep Quality Questionnaire (PSQ). Score calculations were made according to the survey results. Data were analyzed using SPSS 14 program.

Results: A statistically significant difference was found between the patient and control group in all sub-parameters of quality of life ($p < 0.05$). When the mean of all sub-parameters was evaluated, it was detected that all quality of life scores of the patients were lower than the control group. PSQ subscale scores were significantly different between patient and control groups ($p < 0.001$). The total PSQ score of the patients was 9.14 ± 4.07 and the control group was 5.38 ± 3.30 . **Conclusion:** According to our study results, impaired quality of life and sleep observed in DM patients. We think that the evaluation of sociodemographic variables that may affect the quality of life and sleep quality and accordingly planning the treatment strategy would have positive contributions in the treatment of DM.

Keywords: Diabetes mellitus; quality of life; SF-36; quality of sleep

INTRODUCTION

DM is a metabolic disease characterized by hyperglycemia resulting from disorders of insulin secretion, insulin action, or both. Chronic hyperglycemia cause long-term damage and eventually failure of organs, especially at the eyes, kidneys, heart, and blood vessels. (1). Preventing these complications will not only reduce the economic burden of health care system but also will improve the patient's quality of life (2). DM can also lead to mental, emotional, social, and psychosexual problems. It may cause psychiatric disorders by affecting brain functions and also depending on disease perception. This condition that can be seen in the course of DM, may affect the severity and progression of the disease. Therefore, it is important to treat patients with diabetes in a holistic approach. Compared to the general population, patients with diabetes have a high rate of psychiatric symptoms and illness as in other chronic diseases (3).

Quality of life is the most important goal of health interventions and is measured by physical and social functioning perceived as physical and mental (4). It is known that deterioration can be seen in the quality of life of patients with a variety of chronic diseases. Dietary requirements, daily drug use, and disease-related complications may adversely affect quality of life (5). Therefore, measuring the quality of life is important in assessing the impact of disease and monitoring treatment results (6). Quality of life includes physical, mental and social well-being of the patient. The importance of achieving and maintaining a good quality of life is increasingly recognized and emphasized in the diabetes guidelines. It therefore represents an important goal for health care in itself (7).

In society, chronic sleep disorder and poor sleep quality are very common. Poor sleep quality or sleep disturbance increases the risk of developing type 2 DM as well as its negative impact on morbidity and mortality (8). Sleep disturbance due to problems in blood

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sugar regulation increases the risk of cardiovascular death of DM (9). The aim of this study was to evaluate the quality of life and sleep in DM patients.

MATERIAL and METHODS

The study was conducted after the approval of the local ethics committee (decision date: 02/15/2012, number: 2012-224). Participants were selected from DM patients and healthy volunteers who applied to the Internal Medicine Outpatient Clinic of Cumhuriyet University School of Medicine. The study was designed as a prospective cross-sectional study. 100 subjects were included in both groups. Participants were compared in terms of age, gender, marital status, income level, business and education. All participants were asked to complete the SF-36 and PSQ questionnaire. Those under the age of 18 and those who refused to fill out the questionnaire were excluded from the study. The control group was selected from age and sex-matched healthy volunteers who have not any disease.

SF-36 scoring includes 36 questions and provides the evaluation of 8 dimensions. The scale gives the score for each subscale, instead of only a single total score. (10). The subscales assess health from 0 to 100 and 0 indicates poor health, while 100 indicates good health.

SF-36 Components:

1. physical function, (10 items), 2. social functioning, (2 items) 3. physical role function, (4 items) 4. emotional role function, (3 items) 5. mental health, (5 items) 6. wellness/fatigue, (4 items) 7. pain, and (2 items) 8. general health perception, (5 items)

PSQ consists of 24 questions and 7 components. 19 of them are self-evaluation questions, 5 of them are answered by partner or roommate. Each component is evaluated with scores between 0-3. The total score of the scale is between 0-21. The total PSQ score of 5 or higher indicates poor sleep quality (11).

PSQ components:

1. subjective sleep quality, 2. sleep latency, 3. sleep duration, 4. usual sleep activity, 5. sleep disturbance, 6. use of sleep medication, and 7. daytime dysfunction

Statistical Analysis

Data were analyzed by using the Statistical Package for the Social Sciences (SPSS) 14.0 program. The categorical data obtained in the groups were given as absolute numbers and the numerical data as mean $\pm$ standard deviation.

$P < 0.05$ was considered significant. Chi-square test was used to evaluate differences in socio-demographic characteristics and Student's *t* test was used to evaluate differences between groups. Pearson correlation test was used to compare some parameters between the groups.

RESULTS

The study group consisted of 100 patients, of which 56 (56%) were females and 44 (44%) were males. The control group was selected among healthy volunteers including 53 (53%) female and 47 (47%) male. The mean age of the control group was 43 ± 8.9 and the mean age of the patient group was 45.6 ± 10.7 . There was no statistically significant difference between the patients and controls in terms of gender, age, income and marital status ($p > 0.05$). The sociodemographic characteristics of the patient and control groups and the statistical relationship between these characteristics are given in Table 1.

Table 1. Sociodemographic characteristics of the patients and controls

		DM (n=100 N (%))	Control (n=100) N (%)	P value
Gender	Male	47	47	0.670
	Female	56	53	
Marital status	Single	13	24	0.059
	Married	79	74	
	Widow	8	2	
Income status	Low	36	29	0.090
	Medium	54	50	
	High	10	21	
	Not literate	5	0	
	Elementary school	35	22	
Education level	Middle school	18	28	0.025 *
	High school	26	28	
	University	16	22	
	Housewife	35	18	
	Civil servant	14	22	
	Worker	24	19	
Job	Unemployed	1	1	0.041*
	Self-employment	3	10	
	Farmer	3	2	
	Other	20	28	

* $p < 0.05$ significant

When the quality of life subscale scores were compared between the patient and control groups, a statistically significant difference was found in each parameter (p :

0.036 for wellness/fatigue subscale, $p < 0.001$ for all other scales). The mean score of all quality of life sub-parameters was lower in the patients than in the controls. The scores of the quality of life sub-components of the patient and control groups are shown in Table 2.

Table 2. Comparison of quality of life subscale scores of patients and controls

Physical function	Patient	53.81±31.17	$p<0.001^*$ $t=9.23$
	Control	86.04±15.70	
Social function	Patient	61.05±23.24	$p<0.001^*$ $t=4.76$
	Control	75.90±20.79	
Physical role function	Patient	44.55±41.63	$p<0.001^*$ $t=8.18$
	Control	86.25±29.38	
Pain	Patient	57.10±26.58	$p<0.001^*$ $t=5.53$
	Control	75.03±18.83	
Mental health	Patient	51.30±23.54	$p<0.001^*$ $t=3.39$
	Control	61.20±17.23	
Emotional role function	Patient	52.30±39.17	$p<0.001^*$ $t=4.58$
	Control	76.81±37.01	
Wellness/fatigue	Patient	47.65±8.60	$p:0.036^*$ $t=2.10$
	Control	50.11±7.90	
General health perception	Patient	1.37±0.96	$p<0.001^*$ $t:5.97$
	Control	0.81±0.96	

* $p < 0.05$ significant

PSQ subscale scores were compared between the two groups and the difference was found to be statistically significant ($p:0.021$ for sleep time subscale, $p < 0.001$ for other scales). The total PSQ score of the patient group was 9.14 ± 4.07 and the control group was 5.38 ± 3.30 ($p < 0.001$). The scores of the sleep quality sub-components are shown in Table 3.

Table 3. Comparison of PSQ subscale scores of patients and controls

	Group	Mean±SD	P value and t
Subjective sleep quality	Patient	1.47±0.82	$p<0.001^*$ $t:4.55$
	Control	0.99±0.66	
Sleep latency	Patient	1.54±0.85	$p<0.001^*$ $t:4.47$
	Control	0.99±0.88	
Sleep duration	Patient	1.29±1.16	$P:0.021^*$ $t:2.32$
	Control	0.93±1.07	
Usual sleep activity	Patient	1.06±1.14	$p<0.001^*$ $t:5.49$
	Control	0.32±0.70	
Sleep disturbance	Patient	1.74±0.66	$p<0.001^*$ $t:5.38$
	Control	1.24±0.65	
Use of sleep medication	Patient	0.66±1.01	$p<0.001^*$ $t:5.14$
	Control	0.10±0.38	
Total PSQ	Patient	9.14±4.07	$p<0.001^*$ $t:7.14$
	Control	5.38±3.30	

* $p < 0.05$ significant

DISCUSSION

The economic status of the patients included in this study was 36 (36%) low income, 54 (54%) middle income and 10 (10%) high income. The study conducted by Güven

(12) reported that 17.5% of the participant's economic status was poor, 59.8% was moderate and 22.7% was good. Connell et al. (13) reported that patients with better socioeconomic status had better compliance with treatment and quality of life was directly affected by economic status. 35% of the diabetic individuals who participated in our study were housewife, 24% were worker, 14% were civil servants and 20% consisted of others that covered mostly retired people. Likewise, studies examining the similar topics reported that diabetes is common among housewives and retired individuals. (14). This may be due to the fact that the majority of people with diabetes are women. In addition, the fact that women in our country do not play an active role in working life yet may explain why the majority of women are housewives. In addition, the high retirement rate can be attributed to the fact that diabetes is mostly seen in middle age and older.

According to the results of our study, when the quality of life scores were compared between patients and controls, all sub-parameters of quality of life were found to be lower in the patient group compared to the control group. The highest score obtained from the patient group was the social function subscale; the lowest score was the physical role function subscale. The control group obtained the highest score from the physical role function and the lowest score from the general health subscale. Graham et al. (15) reported that the highest score obtained by DM patients was from the general health dimension and the lowest score was the physical functionality dimension. However non-diabetic patients obtained the highest score from the social functioning dimension and the lowest score from the general health dimension. In addition, the calculated sub-dimension scores of diabetic individuals (between 51 and 80) were higher in both our own study (between 45 and 61) and in similar studies conducted previously.

The total PSQ score of the patient group was 9.14 ± 4.07 and was 5.38 ± 3.30 at control. Although sleep need varies from person to person, sleep quality is adversely affected by many factors, particularly in chronic diseases. Sleep, which is necessary for regeneration of metabolism, is impaired in patients with diabetes due to impaired glucose metabolism. In studies conducted on this subject reported that sleep quality is impaired in diabetes. Cunca et al. (16) found that sleep quality was impaired in 48% of patients with Type 2 DM. In the study of Güneş et al. (17) found that there was a significant relationship between diabetes and sleep quality and reported impaired sleep quality of diabetic patients. Jin et al. (18) evaluated the sleep quality of 130 patients with type 2 DM and calculated the total PDQ score of more than 5 in 78 patients, indicating that this reflects poor sleep quality. In addition, parameters such as hemoglobin A1C, hypertension, hs-CRP and diabetes duration were found to be higher in patients with poor sleep quality. In a study evaluating the quality of life and sleep in patients with type 2 DM, poor sleep quality

CONCLUSION

According to our study results, impaired quality of life and sleep in DM patients has been detected. We think that the evaluation of sociodemographic variables that may affect the quality of life and sleep in individuals with DM would have positive contributions to the treatment of DM.

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SCIENTIFIC INVESTIGATIONS

Restless Legs Syndrome in Iranian People With Type 2 Diabetes Mellitus: The Role in Quality of Life and Quality of Sleep

Leila Modarresnia, MD¹; Fatemeh Golgiri, MD¹; Nahid Hashemi Madani, MD¹; Zahra Emami, PhD¹; Kiarash Tanha, MSc²¹Endocrine Research Center, Institute of Endocrinology and Metabolism, Iran University of Medical Sciences (IUMS), Tehran, Iran; ²Department of Biostatistics, School of Public Health, Iran University of Medical Sciences (IUMS), Tehran, Iran**Study Objectives:** To investigate the prevalence of restless legs syndrome (RLS) in patients with type 2 diabetes mellitus (T2DM) and explore its role in quality of life (QoL) and quality of sleep of these patients.**Methods:** This is a cross-sectional study performed on 210 Iranian people with T2DM. The diagnosis of RLS was established based on the essential diagnostic criteria for RLS recommended by the National Institutes of Health. Sleep quality and QoL were assessed in all participants using Pittsburgh Sleep Quality Index and EuroQoL five-dimension questionnaire, respectively. Regression models were used for final analysis of data.**Results:** The prevalence of RLS was 19.5%; of whom 38.1% had poor quality of sleep. Male sex, being single, body mass index (BMI), and RLS were associated with poor quality of sleep. Patients with RLS were almost three times as likely as the patients without RLS to have poor sleep quality. Moreover, being female, BMI value, level of glycosylated hemoglobin (HbA1C), and RLS were associated with lower QoL. RLS lowers the score of QoL even more than BMI and HbA1C. In addition, the QoL and sleep quality of this population of patients with diabetes have not been affected by the severity of RLS as well as presence or absence of neuropathy.**Conclusions:** RLS has an independent and significant role in sleep quality and QoL in the patients with diabetes. Neuropathy with RLS does not confer any additive burden on QoL and sleep quality of this population of patients with diabetes.**Keywords:** quality of life, quality of sleep, restless legs syndrome, type 2 diabetes**Citation:** Modarresnia L, Golgiri F, Madani NH, Emami Z, Tanha K. Restless legs syndrome in Iranian people with type 2 diabetes mellitus: the role in quality of life and quality of sleep. *J Clin Sleep Med*. 2018;14(2):223–228.

INTRODUCTION

Restless legs syndrome (RLS) is a circadian sensorimotor disorder, manifested by an urge to move the legs, and usually associated with uncomfortable sensation in the legs.¹ The urge to move or unpleasant sensation arise or worsen at nights and during the episodes of inactivity, and are partially or totally relieved by movement.¹ RLS is often familial or idiopathic² but may be associated with iron deficiency anemia,³ renal failure,⁴ thyroid disorders,⁵ neuropathy of different causes,⁶ pregnancy,⁷ and type 2 diabetes mellitus (T2DM).⁸

RLS imposes a significant burden not only on quality of sleep and quality of life (QoL)^{2,9} but also on physical health¹⁰ and health-related costs.⁹ Sleep-related symptoms are the most common and most destructive symptoms experienced by patients with RLS.¹¹ Sleep is both quantitatively and qualitatively impaired by RLS.¹¹ Furthermore, sleep disturbance is responsible for a large proportion of burden of RLS on QoL.⁹ The adverse effects of RLS on QoL are more severe than those imposed by hypertension, recent myocardial infarction,

congestive heart failure, angina, diabetes mellitus, and osteoarthritis.¹² In addition, sleep disturbance, a cardinal feature of RLS, has been shown to be a risk factor for impaired glucose tolerance,¹³ insulin resistance, and T2DM.¹⁴

However, diabetes, a lifelong disease of increasing prevalence, is considerably associated with sleep disturbance and subsequently poor glycemic control through different mechanisms.¹⁵ RLS, a common comorbidity in patients with diabetes,^{8,16} can also adversely affect the quality of sleep of these patients.^{16,17} However, this condition is frequently underdiagnosed.⁹ Although identification of sleep abnormalities and their effects on QoL in patients with diabetes is the subject of many studies, only a few studies looked into RLS and its effect on both QoL and quality of sleep of this population. Further understanding of the link between diabetes and RLS is an important part of the efforts done to prevent and treat diabetes complications. Thus, in this study, we investigated the prevalence and severity of RLS in an Iranian population of patients

with T2DM and determined the role of RLS in QoL and quality of sleep in these patients to highlight the burden of this neglected but severely disabling disorder.

METHODS

This is a cross-sectional study on patients with T2DM, done at a tertiary care center, in Iran, Tehran, in 2016. Patients with T2DM, according American Diabetic Association criteria,¹⁸ were selected using the convenience sampling method. The sample size including 210 participants was determined applying the observational study formula.¹⁶ Exclusion criteria were any known chronic kidney disease (CKD), severe heart disease, liver disease, active thyroid disorder, obstructive sleep apnea (OSA), depression, a history of trauma or hospital admission during the past 3 months, diabetic duration of less than 3 months, and age younger than 30 years or older than 70 years. An informed written consent was obtained from all the subjects eligible for including in the study.

The diagnosis of RLS was established by a physician based on the essential diagnostic criteria for RLS recommended by the National Institutes of Health,¹ utilizing the validated Persian language version. The criterion excluding RLS mimics is not included in the National Institutes of Health criteria; however, we excluded RLS mimics (namely, myalgia, venous stenosis, leg edema, leg cramp, positional discomfort, habitual foot tapping) by an exact physical examination and mimics-related questions.¹ Diabetic neuropathy was documented by nerve conduction study. Severity of RLS was evaluated with the International RLS Study Group Rating Scale.¹⁹ RLS severity was classified to mild (0–10), moderate (11–20), severe (21–30), and very severe (31–40) according to total International RLS Study Group Rating Scale scores.

Sleep quality was measured in all participants using Pittsburgh Sleep Quality Index (PSQI).^{20,21} Sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medications, and daytime dysfunction were evaluated subjectively through 19 self-rating items. Each of the seven factors was scored 0 to 3. PSQI total score ranged from 0 to 21; the higher PSQI global score indicates the poorer quality of sleep. PSQI global score higher than 5 has been found to have a sensitivity of 98.7% and specificity of 84.4% in differentiating good sleepers from poor sleepers.²²

QoL was assessed in all participants using EuroQol five-dimension questionnaire (EQ-5D-3L), a standardized tool for measuring general health status.²³ This questionnaire consists of two components, a health state description part and a visual analog scale (VAS).²⁴ Five dimensions of health status, including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, are measured in the description part. The respondents self-rate the level of severity of each dimension using a three-level scale. The VAS indicates health status on the day of interview on a 20-cm vertical scale with end points of 0 and 100.²⁴ In the EQ-5D-3L, the respondent has to draw a line from the box on the questionnaire to the imagined scale.

Weight, height, and blood pressure were measured; another questionnaire including demographic information (age, sex,

occupation, marital status, and smoking status), diabetes-related variables (including duration of diabetes and type of treatment), as well as physician-diagnosed comorbidities (ie, hypertension, hyperlipidemia, thyroid disorders, anemia, CKD, severe heart disease, liver disease, OSA, depression, and hospital admission during the past 3 months) were completed by the participants. In addition, in the same session a blood sample was obtained for laboratory testing of fasting blood sugar, glycated hemoglobin (HbA1C), total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglyceride.

All the questionnaires were completed via a face-to-face interview between trained physicians and participants. The questions that arose during the interview were explained and clarified by the investigators. Moreover, if the participants were unable to complete the questionnaires, the physicians asked them the questions item-by-item orally and recorded the answers truthfully.

Statistical Analysis

Data are presented as mean $\pm$ standard deviation for continuous variables with normal distribution or median and interquartile range for non-normally distributed variables. Categorical data are presented as frequency and percentage. Analysis of variance, Mann-Whitney *U* test, Kruskal-Wallis test, and χ^2 test were used for comparison of variables between groups. Correlations were evaluated using the Spearman correlation coefficient. After performing the univariate analysis, the variables with $P < .2$ were included in multivariate analysis. For multivariate analysis, binary logistic regression model and linear regression analysis were used. A value of $P < .05$ was considered statistically significant. The Statistical Package for Social Sciences (SPSS) version 24 (SPSS Inc., Chicago, Illinois, United States) was used for statistical analysis.

RESULTS

Baseline characteristics of all participants are shown in **Table 1**. Two hundred ten patients with T2DM were included in the study. The mean age of participants was 54.89 ± 7.81 years and mean diabetic duration was 7.8 ± 4.89 years. The prevalence of RLS was 19.5% ($n = 41$) in this population of patients with diabetes, of whom 21 (51.2%) had evidence of neuropathy whereas 20 (48.8%) had no evidence of neuropathy in nerve conduction tests. Based on the International RLS Study Group Rating Scale, 29.3%, 51.2%, 14.6%, and 4.9% of the patients were affected by mild, moderate, severe, and very severe forms of RLS, respectively.

There were 38.1% of all participants and 56.1% of the participants with RLS who had poor quality of sleep. Binary logistic regression model showed poor quality of sleep is associated with male sex (odds ratio [OR] 3.17; 95% CI 1.60–6.29; $P = .001$), being single (OR 3.60; 95% CI 1.04–12.36; $P = .04$), higher body mass index (BMI) level (OR 0.93; 95% CI 0.87–0.98; $P = .014$), and the presence of RLS (OR 2.79; 95% CI 1.30–5.99; $P = .008$), **Table 2**. The effect of RLS on sleep quality was independent of the presence of neuropathy.

Table 1—Baseline characteristics of the participants.

Age (years)		54.89 ± 7.81
Diabetic duration (years)		7.8 ± 4.89
SBP (mmHg)		128.65 ± 19.22
DBP (mmHg)		79.83 ± 9.47
FBS (mg/dL)		154.9 ± 66.2
HbA1C (%)		7.84 ± 1.92
TG (mg/dL)		161.74 ± 96.10
Cholesterol (mg/dL)		166.14 ± 43.08
LDL (mg/dL)		92.37 ± 31.55
HDL (mg/dL)		44.27 ± 11.51
QoL (score)		0.82 ± 0.17
VAS (score)		66.24 ± 18.89
Sex	Male	83 (39.5)
	Female	127 (60.5)
Marital status	Single	26 (12.4)
	Married	184 (87.6)
Smoking status	Yes	15 (7.1)
	No	195 (92.9)
Insulin use	Yes	71 (33.8)
	No	139 (66.2)
RLS	Yes	41 (19.5)
	No	169 (80.5)
RLS	With neuropathy	21 (51.2)
	Without neuropathy	20 (48.8)
PSQI score	≤ 5	130 (61.9)
	> 5	80 (38.1)

Data are presented as mean ± standard deviation or n (%). DBP = diastolic blood pressure, FBS = fasting blood sugar, HbA1C = glycosylated hemoglobin, HDL = high density lipoprotein, LDL = low-density lipoprotein, PSQI = Pittsburgh Sleep Quality Index, QoL = quality of life, RLS = restless legs syndrome, SBP = systolic blood pressure, TG = triglyceride, VAS = visual analog scale.

Linear regression analysis for identifying the associated factors of poor QoL demonstrated the significant effect of sex (male) (coefficient 1.50; $P = .001$), BMI (coefficient -0.008 ; $P = < .001$), HbA1C (coefficient -0.015 ; $P = .02$), and RLS (coefficient -0.08 ; $P = .007$) on QoL (Table 3). In the VAS part of the questionnaire, female sex (coefficient -6.04 ; $P = .03$), duration of diabetes (coefficient -0.62 ; $P = .02$), BMI (coefficient -0.5 ; $P = .02$), and being a smoker (coefficient -16.17 ; $P = .003$) all were associated with an inverse effect on QoL (Table 4). Furthermore, patients with poor quality of sleep showed significantly lower scores in both parts of the EQ-5D-3L questionnaire compared with patients with good quality of sleep (0.80 versus 0.84, $P < .001$, in the health state description part; and 60 versus 70, $P < .001$, in the VAS part). Finally, our data showed that the

Table 2—Binary logistic regression analysis of factors influencing quality of sleep.

Variable	OR (95% CI)	P
Male	3.176 (1.602–6.293)	.001
Single	3.600 (1.049–12.369)	.042
BMI	0.930 (0.878–0.986)	.014
TG	0.998 (0.995–1.001)	.205
RLS	2.793 (1.301–5.998)	.008

Multivariate logistic regression analysis, dependent variable is poor quality of sleep (PSQI > 5) and covariates are: sex, marital status, BMI, TG, and RLS. BMI = body mass index, CI = confidence interval, OR = odds ratio, PSQI = Pittsburgh Sleep Quality Index, RLS = restless legs syndrome, TG = triglyceride.

Table 3—Linear regression analysis of factors influencing QoL.

Variable	Coefficient (SE)	P
Male	1.508 (0.128)	.001
Age (years)	-0.083 (0.025)	.051
BMI (kg/m ²)	-0.008 (0.002)	< .001
HbA1C (%)	-0.015 (0.006)	.021
TG (mg/dL)	-0.0001 (0.0001)	.345
RLS	-0.082 (0.03)	.007
Insulin use	-0.28 (0.028)	.309

Dependent variable is QoL and covariates are: sex, age, BMI, HbA1C, TG, RLS, and insulin use. BMI = body mass index, HbA1C = glycosylated hemoglobin, QoL = quality of life, RLS = restless legs syndrome, SE = standard error, TG = triglyceride.

Table 4—Linear regression analysis of factors influencing VAS.

Variable	Coefficient (SE)	P
Female	-6.048 (10.524)	.038
Diabetic duration (years)	-0.624 (0.269)	.021
BMI (kg/m ²)	-0.558 (0.248)	.026
HbA1C (%)	-0.744 (0.925)	.422
FBS (mg/dL)	-0.02 (0.029)	.482
Smoker	-16.17 (5.442)	.003
Insulin use	-3.124 (3.170)	.326

Dependent variable is VAS and covariates are: sex, diabetic duration, BMI, HbA1C, FBS, smoker, and insulin use. BMI = body mass index, HbA1C = glycosylated hemoglobin, FBS = fasting blood sugar, SE = standard error, VAS = visual analog scale.

mobility problem and pain/discomfort aspects of the QoL are more affected by RLS. Adverse effect of RLS on QoL in patients with neuropathy was the same as those without neuropathy.

DISCUSSION

The prevalence of RLS in this cross-sectional study, carried out in a population of Iranian people with T2DM, was 19.5%,

of whom 51.2% also suffered from neuropathy. Patients with RLS were more likely to have poor quality of sleep (odds ratio 2.79; 95% confidence interval 1.30–5.99; $P = .008$); furthermore, they had a significantly lower QoL score compared to patients without RLS (0.83 versus 0.84, $P = .009$). However, there was no significant difference in QoL and sleep quality of the participants across the spectrum of RLS severity. Furthermore, RLS in the presence of neuropathy did not confer any additional burden on QoL and sleep quality compared to RLS without neuropathy.

The prevalence of RLS in our patients with diabetes (19.5%) is in line with the results of previous studies. Clinically significant RLS, although underdiagnosed,^{2,9} is common (2.7%) in the general population.² However, the prevalence of any form of RLS has been reported to range from 7% to 10%.^{2,25} Moreover, RLS is over four times more common in patients with diabetes than in the general population,⁸ with a prevalence of 10% to 42% in different populations with diabetes.^{26,27}

However, 51.2% of patients with RLS had neuropathy documented by nerve conduction studies. Peripheral neuropathy, one of the most common complications of diabetes, can mimic symptoms of RLS. Uncomfortable sensations of tingling, numbness, burning, and pain all are seen in both conditions, making it difficult to distinguish the two disorders.²⁸ However, some aspects of history and physical examination, as well as the nerve conduction test, can be used to differentiate neuropathy and RLS.²⁸ The fact that not all patients with diabetes and RLS suffered from neuropathy supports the results of previous studies in that neuropathy is not the only leading cause of RLS.²⁹

Poor sleep quality was seen in 38.1% of this population of patients with diabetes, and was associated with male sex, single status, high BMI, and presence of RLS. A large proportion of our patients with diabetes were found to have poor sleep quality, consistent with the previous studies in patients with diabetes.¹⁶ However, the relationship between diabetes and sleep disorders is a complex bidirectional relationship.³⁰ Marriage was a protective factor on quality of sleep among our studied population, similar to the results of another study that showed an elderly population who had ever married or lived with others had a better quality of sleep.³¹ However, in contrast to the results of previous studies,³² we could not find the protective effect of male sex on quality of sleep. This difference may be due to the difference in studied populations because the study of Denic-Roberts et al.³² was conducted among an adult population with long-standing type 1 diabetes in whom non-sex-specific prevalence of sleep disturbance did not differ from that of the general population. Like other studies, poor quality of sleep was also associated with high BMI.³³ Moreover, we found that patients with RLS were almost three times as likely as those without RLS to have poor quality of sleep. This finding strongly supports the results of previous studies regarding the role of RLS in sleep disturbance.¹⁷ Nevertheless, we found no association between some other variables, such as age, diabetic duration, smoking status, blood pressure, fasting blood sugar, HbA1C, total cholesterol, triglyceride, HDL, LDL, and poor quality of sleep. However, previous studies in this respect yielded conflicting results.^{34–36} These controversies may be due

to the difference in studied populations and applied methods. Moreover, there is a complex interrelationship between these demographic and clinical variables and sleep-related components that requires more comprehensive investigations for better understanding.

We also explored the QoL of our participants through EQ-5D-3L questionnaire. Advanced age, high BMI values, high HbA1C level, and being female were associated with lower QoL. Moreover, RLS lowers the score of QoL by 0.08. Considering the VAS part of the questionnaire, which indicates health status on the day of interview, we found lower scores for females, smokers, and patients with longer duration of diabetes and higher BMI. Furthermore, the mobility problem and pain/discomfort dimensions of the questionnaire were more affected by the presence of RLS. Patients with diabetes are known to have worse QoL than individuals without diabetes.³⁷ Our study supports the results of previous studies regarding the fact that being female,³⁸ advanced age,³⁹ higher BMI,³⁹ and poorer glycemic control⁴⁰ all are associated with lower QoL in patients with diabetes. In addition, we did not find any negative effect of duration of diabetes and insulin use on QoL, like some other studies.^{41,42} However, some controversies still exist about these findings.^{39,43,44} These controversies may be due to the influence of several factors such as the existence of other health problems, the presence of diabetes-related complications, living status (with family or alone), social relationship, and the level of education that obviously are not considered in all studies and may confound the results. Among the factors that affect QoL of patients with diabetes, RLS is more consistently associated with low QoL.^{2,12,45} It can adversely affect both physical and mental aspects of QoL.^{10,45} A study by Kushida et al. showed that RLS is associated with a unique burden on both mental and physical aspects of QoL in the general population, and this burden is even greater than that imposed by T2DM.¹⁰ Moreover, our study showed that RLS lowers QoL of the patients with diabetes, even more than obesity and high HbA1C level. Thus, physicians should pay as much attention on the evaluation and treatment of RLS as they do on the other predictors of poor QoL in patients with diabetes.

In addition, both RLS and neuropathy can interfere with sleep.²⁸ Furthermore, it is well established that RLS and neuropathy are independent predictors of poor QoL in patients with diabetes.^{45,46} Our study showed that although RLS impairs QoL of patients with diabetes, neuropathic RLS does not confer additive burden on QoL compared to RLS without neuropathy.

To our knowledge, this was the first study that addressed the prevalence and severity of RLS in Iranian people with T2DM and examined the role of RLS across the spectrum of its severity on both QoL and sleep quality of these patients. Another new aspect of our study is that we compared the effect of RLS with and without neuropathy on QoL and sleep quality of patients with diabetes. Furthermore, we excluded some other diseases such as CKD, OSA, and thyroid disorders that have the potential to affect the QoL of patients with diabetes.

However, the interpretation of the results has some limitations. First, because it is a cross-sectional study, determination of causality cannot be established. Second, evaluation of sleep was subjective and self-reported. Obviously objective

measures (eg, polysomnography) would offer more valid results. And finally, there were a few confounders that were not adjusted, such as diabetic-related complications other than CKD, some other comorbidities, socioeconomic factors, and education level that may have an important role in quality of sleep and QoL.

In conclusion, the prevalence of RLS in this population of Iranians with T2DM was 19.5%. A large portion of this population (51.2%) had a moderate form of RLS whereas a small number of them (4.9%) showed a very severe form of this disorder. Poor sleep quality was associated with being male, single status, high BMI, and the presence of RLS. Patients with RLS were almost three times as likely as those without RLS to have poor quality of sleep. In addition, poor QoL in this population of patients with diabetes was associated with being female, high level of HbA1C, high BMI, and presence of RLS. RLS lowers QoL score even more than HbA1C and BMI. Moreover, RLS affects the mobility problem and pain/discomfort aspects of QoL. Furthermore, RLS impairs the QoL and sleep quality of this population of patients with diabetes independently of the presence of neuropathy.

ABBREVIATIONS

BMI, body mass index
CKD, chronic kidney disease
EQ-5D-3L, EuroQol five-dimension questionnaire
FBS, fasting blood sugar
HbA1C, glycated hemoglobin
HDL, high-density lipoprotein
LDL, low-density lipoprotein
PSQI, Pittsburgh Sleep Quality Index
QoL, quality of life
RLS, restless legs syndrome
T2DM, type 2 diabetes mellitus
TG, triglyceride
VAS, visual analog scale

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Original research

Quality of life and sleep quality are similarly improved after aquatic or dry-land aerobic training in patients with type 2 diabetes: A randomized clinical trial

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Objectives: To compare the effects of two aerobic training models in water and on dry-land on quality of life, depressive symptoms and sleep quality in patients with type 2 diabetes.

Design: Randomized clinical trial.

Methods: Thirty-five patients with type 2 diabetes were randomly assigned to aquatic aerobic training group (n = 17) or dry-land aerobic training group (n = 18). Exercise training length was of 12 weeks, performed in three weekly sessions (45 min/session), with intensity progressing from 85% to 100% of heart rate of anaerobic threshold during interventions. All outcomes were evaluated at baseline and 12 weeks later.

Results: In per protocol analysis, physical and psychological domains of quality of life improved in both groups (p < 0.05) without between-group differences. Overall quality of life and sleep quality improved in both groups (p < 0.05), without between-group differences in per protocol and intention to treat analysis. No changes on depressive symptoms were observed in both groups at follow-up.

Conclusions: Aerobic training in an aquatic environment provides similar effects to aerobic training in a dry-land environment on quality of life, depressive symptoms and sleep quality in patients with type 2 diabetes.

Clinical trial reg. no. NCT01956357, clinicaltrials.gov.

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1. Introduction

Type 2 diabetes (T2DM) is a chronic disease, marked by its impact on physical health, such as at critical changes on metabolic, functional and cardiovascular impairments.^{1,2} In addition, or as consequence of the impact on physical health, people with T2DM also presents impairments on mental health outcomes, such as sleep quality and depressive symptoms.^{3,4} All together, these alter-ations lead patients to an expressive worsening in the quality of life (QoL). In fact, when compared to the non-diabetic population, these individuals present a worse QoL in several domains, including, but not limited to physical, psychological and

social.⁵

High levels of physical activity (PA) and involvement in structured exercise training programs are associated with better QoL in patients with T2DM.⁶ In addition, specific characteristics such as weekly volume⁷ and exercise supervision⁸ seems to moderate the effects of training on patients QoL.

Although different modalities of structured exercise programs are indicated on diabetes management, aerobic training has been the traditionally recommended and prescribed form, providing clear acute and chronic benefits for patients with T2DM^{9,10}

although similar benefits can be obtained with resistance or combined exercise training.¹¹

Previous studies with aerobic training have found that the most beneficial exercise programs are those with high volume,¹² intensity¹³ and that make progression of the training variables.¹⁴ However, these studies are performed in dry-land environment, which may expose patients to moderate to high impact forces on their musculoskeletal system, especially in running.¹⁵ Importantly, as patients with diabetes are prone to chronic complications, including peripheral neuropathy that increases risk of foot lesions, it is important to find alternatives for the adequate dosage of exercise training.

Exercise alternatives for patients with T2DM include aquatic exercises, in which the physical properties of water can provide low impact forces on the lower limb joints, probably making it safer as regards joint damage.¹⁶ These characteristics are especially relevant in the case of diabetes, due to its frequent association with obesity,¹⁷ lower strength and functional capacity.² Thus, the aquatic environment favors exercise training due its lesser risks of injuries and ulceration caused by the impact being directly absorbed by the foot in contact with the ground. Moreover, the aquatic environment allows the achievement of training with open kinetic chain, without impact on the musculoskeletal system, such as deep-water running.¹⁸ Although some studies have been showed similar metabolic, cardiorespiratory and functional effects after training in different environments (aquatic or dry-land) in patients with T2DM,¹⁰ mental health outcomes and QoL have not been evaluated after training in these two environments yet. Considering this caveats, the aim of this study was to compare the effects of two aerobic training models (aquatic vs. dry-land training) on QoL, depression symptoms and sleep quality in patients with T2DM. Our hypothesis is that aerobic training will present positive and similar effects in all evaluated outcomes in the two environments (aquatic and dry-land).

2. Methods

Patients with T2DM were recruited through advertisements in local newspapers. Inclusion criteria were: T2DM, not engaged in regular exercise (defined as not exercising more than 20 min on 3 or more days a week), 30 years old or more, and having had an electrocardiogram (ECG) stress test performed recently (6 months preceding the study). Exclusion criteria were severe autonomic neuropathy, severe nonproliferative and proliferative diabetic retinopathy, decompensated heart failure, limb amputations, chronic renal failure (MDRD-GFR <30 ml/min),¹⁹ or any muscle or joint impairment which prevented individuals from engaging in physical exercise.

All participants provided written consent prior to participation. This study was approved by the Research Ethic Committee of the Universidade Federal do Rio Grande do Sul (protocol number 108997) and was registered in Clinical trials (number NCT01956357).

Eligible patients were randomized to either an aquatic aerobic training (AT) or dry-land aerobic training (DLT) by picking an envelope with predefined group numbers, using a 1:1 ratio and stratified according to gender. The randomization procedure was performed after baseline evaluations.

Participants underwent a 12-week training program with three weekly sessions. Training intensity was prescribed according to the corresponding anaerobic threshold heart rate (HR_{AT}), determined by heart rate deflection point,²⁰ which was determined by progressive exercise tests conducted in the water or on dry-land for the AT and DLT groups, respectively. The incremental test in the water was a mode-specific deep-water running test based on

the study of Kanitz et al.,²¹ and the incremental test on land was performed in treadmill, according Delevatti et al.^{9,10} The modalities adopted were walking and/or running in deep water (AT), and walking and/or running on athletic track (DLT). Participants trained wearing heart rate (HR) monitors (RSX 300, Polar, Kajaani, Finland) during exercise to control training intensity. Each 45-min session was divided into a warm-up period (5 min), followed by the main training program (35 min) and a cool down period (5 min). Both groups underwent interval-training programs, with the following periodization: weeks 1–3, 7 sets (3 min 85–90% HR_{AT} with 2 min <85% HR_{AT}); weeks 4–6, 7 sets (4 min 85–90% HR_{AT} with 1 min <85% HR_{AT}); weeks 7–9, 7 sets (4 min 90–95% HR_{AT} with 1 min <85% HR_{AT}); weeks 10–12, 7 sets (4 min 95–100% HR_{AT} with 1 min <85% HR_{AT}). Both groups had identical periodization, differing only with regard to the training environment.

At the first week of assessments, participants realized clinical evaluations including body composition tests. Initially, height, body mass, waist circumference, and the sum of eight skinfolds (Σ SF) were calculated. The equations proposed by Petroski²² were used to estimate the body density of men and women, while body fat percentages were estimated using the Siri formula.²³ Following the clinical assessments, QoL, depressive symptoms and sleep quality were evaluated.

In the second week, participants were familiarized with the training programs that they subsequently underwent, with the training environment, and with the equipment used during experimental sessions. In the third week of pre-training evaluation, a graded exercise test was performed. This test was conducted on a previously calibrated treadmill (Inbramed, Porto Alegre, Brazil) with initial velocity of 3 km h⁻¹ for 3 min, fixed inclination (4%) and increments of 1 km h⁻¹ every 2 min, until exhaustion. Heart rate was monitored every 10 s (Polar, Kajaani, Finland) and the rate of perceived exertion (Borg Scale) was measured in the final 20 s of each stage.

Quality of life was considered the primary outcome, being assessed using the portuguese version of the World Health Organization QoL-Bref (WHOQOL-BREF).²⁴ The WHOQOL-BREF is a self-assessment, 26-item, short version of the WHOQOL-100 instrument. The results are presented in four domains (physical, psychological, social relationships, and environment) with scores ranging from 0 to 100 (0 indicates the worst QoL and 100 better QoL).²⁴

Secondary outcomes were depressive symptoms and sleep quality. Depressive symptoms were evaluated using the Beck Depression Inventory (BDI).²⁵ The BDI is a 21-item, self-assessment instrument that is widely used in research and clinical practice. BDI scores range from 0 to 63, with 0–9 indicating minimal depression, 10–18 mild depression, 19–29 moderate depression, and 30–63 severe depression.

Sleep quality was evaluated by Pittsburgh Sleep Quality Index (PSQI).²⁶ PSQI is an instrument that assesses subjective sleep quality and related disorders. PSQI comprises seven domains divided in 10 questions, of which questions 1–4 are open and 5–10 are semi-open. PSQI scoring scale ranges from zero to 21 and scores greater than 5 indicate poor sleep quality. Each domain has a set weight between zero and three and global score is given by the sum of the scores in the seven domains.

All outcomes were evaluated at baseline and at the end of the interventions. All analyses were performed by blinded evaluators. Post-training evaluation was conducted 72 h after the last exercise session.

Descriptive data from characterization of participants and training adherence are presented as mean and standard deviation or median and interquartile range (P25–P75) for continuous variables and as raw numbers (*n*) for categorical variables. Baseline

Table 1

Participants' characteristics.

	AT (n = 17)	DLT (n = 18)	P value
Age (years)	54.2 ± 8.3	59.2 ± 6.9	0.062
Duration of diabetes (years)	10.3 ± 3.0	10.0 ± 6.1	0.093
Body mass (kg)	92.9 ± 18.6	79.5 ±	0.005
BMI (kg/m ²)	34.4 ± 3.7	12.6	0.001
Waist circumference (cm)		30.0 ± 3.1	0.026
	110.9 ±	102.3 ±	0.096
WHR	0.68 ± 0.08	0.60 ±	
		0.17	
Fat percentage	37.7 ± 4.0	32.6 ± 6.5	0.009
Gender (F/M)	10/7	10/8	>0.99
Medical treatment			9
Metformin	16	16	>0.99
Sulphonylurea	8	5	9
DPP-4 inhibitors	2	2	0.305
			>0.99
Pioglitazone	1	0	9
			>0.99
Diuretics	5	5	9
			>0.99
Beta-blockers	5	4	0.711
ACE-inhibitors	3	5	0.691
ARA II	4	4	9
			>0.99
Calcium channel blockers	1	1	9
Aspirin	5	5	9
			>0.99
Statins	9	6	0.315
Insulin	4	2	0.402
Antidepressants	3	4	>0.99
			9

AT: aquatic exercise training; DLT: dry-land exercise training. DPP-4: dipeptidyl peptidase-4; ACE: angiotensin conversion enzyme; ARA: angiotensin receptor antagonists; WHR: waist to height ratio. differences were compared using Fisher's exact test for categorical variables and unpaired t-test for continuous variables.

A generalized estimating equation (GEE) was used to assess before and after intervention changes within and between groups (time effect, group effect and group*time interaction effect). No covariates were added to the GEE models. Multiple comparisons were performed with the Bonferroni correction. Per protocol and intention-to-treat analyses were performed for all outcomes. All participants without follow-up data, that dropped out or that did not completed at least 80% of sessions were excluded of per-protocol analyses. The level of significance was set at $p < 0.05$. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) software, version 20.0.

3. Results

Of the 95 patients assessed for eligibility, 35 were randomized and 21 were included in a per protocol analysis. Of the 14 people who were not included in this analysis, 10 (AT, $n = 3$; DLT, $n = 7$) dropped out of the study and four (AT, $n = 3$; DLT, $n = 1$) had inadequate adherence ($< 80\%$). To perform intention-to-treat analysis, all randomized patients were invited to undertake post-training evaluation. However, six patients (AT, $n = 2$; DLT, $n = 4$) did not attend for these evaluations (Fig. 1).

Baseline characterization of participants is presented in Table 1. Body mass index, waist circumference, and fat percentage were higher in those who were randomized for the AT. Other characteristics were similar between groups.

Overall and physiological and psychological domains of QoL improved in both groups in per protocol analysis, without between-group difference. Improve in overall QoL was confirmed in the intention-to-treat analysis, of similar form in both groups (Table 2).

QoL in the environmental and social relationship domains and depressive symptoms did not after the training interventions; these results were confirmed by per protocol and the intention-to-treat analyses. Sleep quality improved in both groups in the two analyses performed, without between-group difference (Table 2).

Aquatic training was well tolerated by participants, with no adverse effect occurring during the intervention in the AT group. In contrast, four hypoglycemic episodes occurred during the exercise sessions in the DLT group, however without differences between groups ($p = 0.104$). All episodes were successfully treated with glucose ingestion. Osteoarticular injury or pain occurred in five participants of DLT. Of these, two participants quit the study due to articular injuries and three participants reported osteoarticular pain associated with the training sessions ($p = 0.045$).

Considering the participants who completed the training protocol (AT group, $n = 14$; DLT group, $n = 11$), adherence to the training intervention was 85.9% for the AT group and 89.1% for the DLT group. Considering the subjects included in the per protocol analysis ($n = 21$), there was no difference in adherence to training between the experimental groups (DLT: 33.2 or 92.2% of 36 exercise sessions vs. AT: 32.2 or 88.1% of 36 exercise sessions ($p = 0.139$).

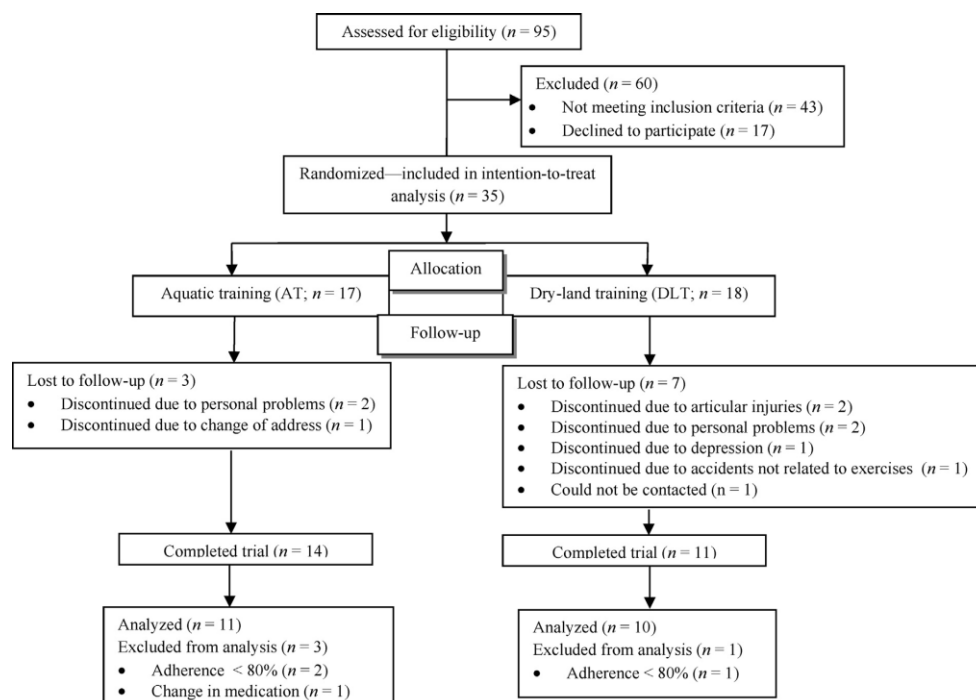
4. Discussion

The present study demonstrates that an aerobic training program realized in aquatic environment improve QoL and sleep quality of patients with T2DM similarly to an aerobic training program on dry-land, being an excellent alternative for this population. Improves on physical and psychological domains of QoL (per protocol analysis) and on overall QoL with aquatic training are of clinical relevance for people with T2DM since the complications and comorbidities of T2DM such as obesity and functional disability, frequently hinder them from engaging in land-based walking or running. Therefore, it can be an alternative strategy with similar effects on QoL.

The lack of effects on the social and environment domains of QoL were somewhat expected since these domains evaluate aspects such as interpersonal relationships, social support, sexual activities, physical security, financial resources, among other aspects that are not directly associated with exercise practice.²⁴

On dry-land environment, the positive effects of the supervised exercise training in QoL improve of the patients with T2DM has been demonstrated.^{7,8} With supervised exercise training on aquatic environment, this is the first study to evaluate QoL using WHOQOL-brief in patients with T2DM. Previous study using the SF-36²⁷ found improvements in physical and emotional domains, and in the sum of the mental health components following 12 weeks of aquatic combined training. In addition, Asa et al.²⁸ found improve only in vitality domain after 8 weeks of aquatic combined training. Possibly, the shortest intervention period of this study may to explain the reduced effect on QoL compared to our findings and those from Cugusi et al.²⁷ Despite of the different evaluation instrument (SF-36 vs. WHOQOL-brief) and training modality (combined vs. aerobic), the findings of ours study are in accordance with the literature, being the QoL improves relating to physical and psychological dimension.

Depressive symptoms were not improved by our exercise interventions. This result is somewhat unexpected since there is consistent evidence of the benefits of exercise on depressive symptoms.²⁹ Potentially, the lack of effects on depressive symptoms may be due an ceiling effect in which the participants of the present study presented low depression scores at baseline (9 ~ points in BDI instrument). However, considering that people with T2DM are in risk increased for developing depression,⁴ the maintenance of depressive symptoms can be considered of great value. Overall QoL and sleep quality were similarly improved in both groups, both in per protocol and intention to treat analyses. These

**Fig. 1.** Flowchart of participants' progress through the phases of the trial.**Table 2**

Main and secondary outcomes for the aquatic training group (AT) and the dry-land training group (DLT) before and after 12 weeks of training.

	Per protocol analysis					
	AT (n = 11)			DLT (n = 10)		
	Pre	Post	Difference	Pre	Post	Difference
Overall QoL	55.1 ± 5.5	69.6 ± 3.5*	14.1	57.6 ± 3.5	65.1 ± 4.2*	7.5
Physical domain – QoL	61.3 ± 4.7	66.7 ± 3.8*	5.4	61.0 ± 4.3	66.4 ± 4.7*	5.4
Psychological domain – QoL	70.0 ± 2.6	72.0 ± 3.8*	2.0	62.9 ± 2.8	68.7 ± 3.6*	5.8
Environment domain – QoL	62.5 ± 2.8	65.3 ± 3.1	2.8	64.6 ± 4.6	65.0 ± 3.5	0.4
Social relationship domain – QoL	67.4 ± 3.7	64.1 ± 4.7	−3.3	62.5 ± 4.8	62.5 ± 6.0	0.0
Depressive symptoms	9.7 ± 1.1	8.4 ± 1.6	−1.3	10.0 ± 1.1	9.3 ± 1.7	−0.7
Sleep quality	8.1 ± 0.8	6.7 ± 0.6*	−1.4	8.6 ± 1.8	7.1 ± 1.1*	−1.5
Intention-to-treat analysis						
	AT (n = 17)			DLT (n = 18)		
	Pre	Post	Difference	Pre	Post	Difference
Physical domain – QoL	64.9 ± 3.5	68.6 ± 3.3	3.7	63.0 ± 3.1	63.2 ± 3.9	0.2
Overall QoL	55.1 ± 5.5	69.6 ± 3.5*	14.1	57.6 ± 3.5	65.1 ± 4.2*	7.5
Psychological domain – QoL	68.8 ± 2.2	72.0 ± 3.2	3.2	67.8 ± 2.9	67.8 ± 3.4	0.0
Environment domain – QoL	62.3 ± 2.4	64.9 ± 2.5	2.6	65.1 ± 4.2	65.8 ± 3.5	0.7
Social relationship domain – QoL	64.2 ± 3.6	65.4 ± 3.9	1.2	63.8 ± 4.2	64.2 ± 5.1	0.4
Depressive symptoms	9.1 ± 1.1	7.9 ± 1.6	−1.2	8.8 ± 0.8	9.2 ± 1.4	0.4
Sleep quality	7.9 ± 0.6	6.3 ± 0.5*	−1.6	7.6 ± 0.8	7.0 ± 0.9*	−0.6

Intention-to-treat analysis, AT: post-training data collected of 15 participants and DLT: post-training data collected of 14 participants. Data of the others participants were estimated by GEE.

* $p < 0.05$ for time effect (pre vs. post training).

findings demonstrate the responsiveness of these outcomes to aerobic training, regardless of the environment in which it is performed (dry-land or aquatic). The increase on sleep quality is of great clinical relevance since people with T2DM has demonstrated sleep complains.^{3,30} Clearly, the sleep complains can affect the overall QoL.

The improvements found in overall, and physical and psychological domains of QoL found in the present study may be in part due the improvements on sleep quality. Also, previous studies have found that improvements on QoL following water-based exercise in post-menopausal women are mediated by improvements on depressive symptoms.²⁹ In the present study, it has not occurred. Other factors such as improvement on physical functioning and physical capacity found in this sample and previously published may also contribute to explain the quality of life improvements.¹⁰ A strength of the present study is that the training periodization was the same at the two groups, differing only with regard to the training environment. Also, the exercise training programs tightly controlled, with extensive monitoring of training variables to secure that both groups realized the sessions at the proposed intensity. Furthermore, the exercise prescription in the aquatic environment was based on data obtained in a mode-specific deep-water running test, providing the same physiologic conditions as the training sessions. The exercise prescriptions performed in the aquatic environment are easily obtainable and well-tolerated by participants, which has important implications for refining future physical activity recommendations. On the other hand, the study has two main limitations: (1) The absence of a group without conducting structured exercise, a classic control group. However, as the primary objective of this study was to compare the effects of the same training between two distinct environments, we believe that design adopted was appropriate to answer our research question; and (2) The sample size can be considered small. This may be important and may help to explain the counterintuitive results of the exercise effects on depressive symptoms. However, we were able to demonstrate improvements on both groups in the main outcome.

5. Conclusion

In summary, the present study shows that aerobic exercise training can exert beneficial effects on overall QoL and in physiological and psychological domains, as well as on sleep quality. These beneficial results are not dependent on the environment (i.e., aquatic or dry-land) where the exercise sessions are performed. The present data confirm the safety and efficacy of aquatic exercise training as a means of treatment for T2DM, similarly to exercise training on dry-land. Aquatic exercise training represents a possible alternative for training of patients with particular injuries or complications that impair the adequate progression of a training program performed on dry-land.

Practical implications

- Aquatic aerobic training contributes similarly to dry-land aerobic training for improving QoL and sleep quality in patients with type 2 diabetes.
- An interval aerobic training with moderate duration (35 min) and intensity (85–100% HR_{AT}) can be used for exercise training prescription for patients with type 2 diabetes.
- The strategy of progression in intensity every three weeks (meso-cycle) was well tolerated by the patients trained in aquatic environment.

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Lampiran 8

Hubungan Kualitas Tidur dengan Kualitas Hidup Lansia dengan Penyakit Diabetes Mellitus Tipe 2

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Abstrak

Latar Belakang dan Tujuan: Salah satu tanda dan gejala Diabetes Mellitus (DM) yaitu sering buang air kecil dalam jumlah banyak pada malam hari sehingga berdampak pada kualitas tidur. Tidur yang efektif pada pasien DM sangat dibutuhkan untuk memperbaiki sel-sel yang rusak termasuk sel beta yang berfungsi untuk memproduksi insulin. Tujuan penelitian ini untuk mengetahui hubungan kualitas tidur dengan kualitas hidup pada lansia dengan penyakit DM tipe 2.

Metode: Desain penelitian menggunakan deskriptif korelasi dengan pendekatan *cross sectional*. Penelitian ini dilakukan di Prolanis Sanang Barigas Palangka Raya. Jumlah responden yaitu 33 responden. Teknik pengambilan data dilakukan secara simultan atau pada suatu waktu (*point time approach*). Analisis data menggunakan uji *Chi Square*.

Hasil: Mayoritas responden berjenis kelamin laki-laki yaitu 20 orang (60,6%), usia hampir seluruhnya sekitar 60-74 tahun yaitu 29 responden (87,9%), pekerjaan mayoritas pensiunan sebanyak 20 responden (60,6%), tingkat pendidikan paling banyak adalah lulusan SMA 15 responden (45,5%), mayoritas kualitas tidur buruk dengan jumlah 19 responden (57,6%), dan sebagian besar kualitas hidup buruk dengan jumlah 19 responden (57,6%). Hasil penelitian menunjukkan terdapat hubungan yang signifikan antara kualitas tidur dengan kualitas hidup lansia dengan DM tipe 2 (*p-value* 0,000 < 0,05).

Simpulan dan Implikasi: Kualitas tidur menentukan kualitas hidup lansia dengan penyakit DM tipe 2. Semakin buruk kualitas tidur lansia maka semakin buruk pula kualitas hidupnya. Dengan demikian intervensi lebih lanjut mengenai perbaikan kualitas tidur diperlukan untuk meningkatkan kualitas hidup lansia dengan penyakit DM tipe 2.

Kata Kunci: Diabetes Mellitus; Kualitas hidup; Kualitas tidur; Lansia

Sitasi: Berthiana & Kasuma WA. (2020). Hubungan kualitas tidur dengan kualitas hidup lansia dengan penyakit diabetes mellitus tipe 2. *The Indonesian Journal of Health Science*. 12(1), 11-16

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Diterbitkan Oleh: Universitas Muhammadiyah Jember

Abstract

Background and Aim: One of the signs and symptoms of Diabetes Mellitus (DM) is polyuria in large quantities at night so that it has an impact on sleep quality. Effective sleep in diabetic patients is needed to repair damaged cells, including beta cells that function to produce insulin. The Aim of this research is to determine the relationship of the quality of sleep and quality of life in older adults with type 2 Diabetes Mellitus.

Method: This research is descriptive correlation with cross sectional approach. This research conducted in Prolanis Sanang Barigas Palangka Raya. The number of respondents were 33 respondents. Data collected retrieval techniques simultaneously or at a time (point time approach). Data were analyzed used Chi Square test.

Results: Majority of respondents were male 20 respondents (60.6%), almost all of them are around 60-74 years old 29 respondents (87.9%), the majority of prefession were retirees 20 respondents (60.6%), education level most of them were high school graduates 15 respondents (45.5%), respondents majority had poor sleep quality 19 respondents (57.6%), and most of them had poor quality of life 19 respondents (57.6%). The results showed that there was a significant relationship between sleep quality and quality of life in the elderly with type 2 diabetes mellitus ($p\text{-value } 0.000 < 0.05$).

Conclusion: Sleep quality determines the quality of life of the elderly with type 2 diabetes mellitus. The worse the quality of sleep for the elderly, the worse the quality of life. Thus, further intervention regarding the improvement of sleep quality is needed to improve the quality of life of the elderly with type 2 diabetes mellitus.

Keywords: Diabetes Mellitus; Elderly; Sleep quality; Quality of life,

PENDAHULUAN

Gangguan tidur menyebabkan berbagai gangguan seperti gangguan sistem kardiovaskular dan endokrin, serta memperberat persepsi nyeri (Al-Maskari, et.al, 2011; Chang, et.al, 2010). Empat gejala utama menandai sebagian besar gangguan tidur yaitu; insomnia, hipersomnia, parasomnia, dan gangguan jadwal tidur-bangun. Gangguan tidur membuat kualitas tidur terganggu (American Diabetic Association, 2015; Bustan, 2015). Kualitas tidur adalah kepuasan seseorang terhadap tidur, sehingga seseorang tersebut tidak memperlihatkan perasaan lelah, mudah terangsang dan gelisah, lesu dan apatis, kehitaman di sekitar

mata, kelopak mata bengkak, konjungtiva merah, mata perih, perhatian terpecah-pecah, sakit kepala dan sering menguap atau mengantuk (Budiatri et al, 2013).

Berdasarkan hasil studi pendahuluan yang dilakukan peneliti pada tanggal 22 Februari 2019 di Prolanis Sanang Barigas Palangka Raya terdapat 33 lansia yang menderita diabetes mellitus. Prolanis Sanang Barigas merupakan Prolanis dengan jumlah paling banyak lansianya yang aktif dibandingkan prolanis lain. Saat peneliti melakukan wawancara didapatkan hasil 4 dari 5 lansia mengalami gangguan tidur.

Gangguan tidur yang terjadi pada penderita diabetes mellitus akan

menyebabkan penurunan pada kualitas hidupnya. Pasien yang menderita penyakit diabetes mellitus yang menjalani terapi pengobatan dapat mempengaruhi kapasitas fungsional, psikologis dan kesehatan sosial serta mempengaruhi kesejahteraan yang didefinisikan sebagai kualitas hidup atau *quality of life* (QoL) (Wimpie, 2007). *Quality of Life* adalah kondisi dimana pasien yang menderita penyakit yang sedang dideritanya dapat tetap merasa nyaman secara fisik, psikologis, sosial maupun spiritual serta secara optimal memanfaatkan hidupnya untuk kebahagiaan dirinya maupun orang lain. Rata-rata pasien penyandang diabetes mellitus umumnya mengalami gangguan kualitas tidur, dikarenakan sering terbangun di malam hari untuk buang air kecil atau merasa haus sehingga kualitas tidurnya terganggu. Gangguan kualitas tidur tersebut jika terus berkelanjutan akan berdampak pada penurunan kualitas hidup pasien penyandang diabetes mellitus (Fitri, 2015).

Pengukuran kualitas hidup bersifat multidimensi yang meliputi fungsi fisik, psikologis, sosial, lingkungan dan kualitas hidup secara umum. Pengukuran kualitas hidup bisa dilakukan dengan menggunakan kuesioner yang dikembangkan oleh WHO (2004). Para penderita diabetes mellitus dikatakan memiliki hidup yang berkualitas apabila mereka memiliki kondisi fungsional yang optimal, sehingga mereka dapat menikmati kehidupannya dengan penuh makna, membahagiakan dan berguna. Gangguan kualitas tidur pada lansia yang menderita diabetes mellitus dapat mempengaruhi kualitas hidup lansia tersebut seperti kualitas hidup yang buruk, fisik,

emosi, dan sosial. Dengan demikian maka tujuan penelitian ini untuk mengetahui apakah ada hubungan antara kualitas tidur dengan kualitas hidup lansia yang mempunyai penyakit DM tipe 2.

METODE PENELITIAN

Desain penelitian

Desain penelitian menggunakan deskriptif korelasi dengan pendekatan *cross sectional*. Populasi dalam penelitian adalah seluruh lansia anggota prolanis yang menderita Diabetes Melitus tipe 2 di Klub Prolanis Sanang Barigas Palangka Raya yang berjumlah 33 orang. Untuk mendapatkan populasi target dilakukan filter menggunakan kriteria inklusi dan kriteria eksklusi. Kriteria inklusi dalam penelitian ini antara lain: lansia yang berusia 60 tahun ke atas, masih dapat berkomunikasi agar mempermudah proses penelitian, tidak mengalami gangguan pendengaran, bersedia menjadi responden. Kriteria eksklusi dalam penelitian ini antara lain: lansia yang mengkonsumsi obat tidur, lansia yang mengalami demensia. Berdasarkan kriteria inklusi dan kriteria eksklusi tersebut, maka jumlah populasi dalam penelitian ini berjumlah 33 lansia. Teknik pengambilan sampel dalam penelitian ini adalah total sampling. Jadi, karena peneliti menggunakan teknik pengambilan total sampling maka sampel dalam penelitian ini berjumlah 33 orang.

Instrumen

Kuesioner pada penelitian ini menggunakan kuesioner PSQI. PSQI adalah kuesioner yang digunakan untuk menilai kualitas tidur dan

gangguan tidur dari seseorang. *Pittsburgh Sleep Quality Index* (PSQI) dikembangkan oleh *The Hartford Institute for Geriatric Nursing, College of Nursing*, New York University. PSQI memiliki konsistensi internal dan koefisien reliabilitas sebesar 0,83 untuk ketujuh komponennya. PSQI terdiri dari 19 pertanyaan dari 7 (tujuh) komponen, yaitu kualitas tidur subyektif, latensi tidur, durasi tidur, efisiensi tidur, gangguan tidur, penggunaan obat tidur dan disfungsi aktivitas siang hari. Masing-masing komponen memiliki kisaran nilai 0-3 dengan 0 menunjukkan tidak adanya kesulitan tidur dan 3 menunjukkan kesulitan tidur yang berat. Jumlah skor dari ketujuh komponen ini menghasilkan satu skor global. Semakin kecil skor global, semakin menunjukkan kualitas tidur yang lebih baik.

Instrumen WHOQOL-BREF ini merupakan rangkuman dari *World Health Organization Quality of Life* (WHOQOL) –100 yang terdiri dari

26 pertanyaan. WHOQOL– BREF terdiri dari dua bagian yang berasal dari kualitas hidup secara menyeluruh dan kesehatan secara umum, dan satu bagian yang terdiri dari 26 pertanyaan yang berasal dari WHOQOL – 100. Menurut Raudhah (2012) untuk menilai (WHOQOL) – BREF, maka ada empat aspek yang digabungkan yaitu aspek fisik, psikologis, hubungan sosial, dan lingkungan.

Analisis Data

Analisis univariat dilakukan pada masing-masing variabel yaitu untuk mendeskripsikan karakteristik responden penelitian yang meliputi umur, jenis kelamin, pendidikan, dan pekerjaan. Hasil analisis data

penelitian yang dilakukan oleh peneliti akan disajikan dalam bentuk tabel distribusi frekuensi dan persentase dari tiap variabel. Analisis Bivariat digunakan untuk mengetahui ada tidaknya hubungan antara variabel independen yaitu kualitas tidur terhadap variabel dependen yaitu kualitas tidur. Analisis ini menggunakan *chi-square test*, dengan $p\text{-value} \leq 0,05$ artinya ada hubungan signifikan secara statistik antara variabel independen dan variabel dependen, dan $p\text{-value} \geq 0,05$ yang artinya tidak ada hubungan signifikan secara statistik antara variabel independen dan dependen.

HASIL

Berdasarkan tabel 1 dapat diketahui bahwa dari 33 responden yang diteliti penderita diabetes melitus yang berjenis kelamin laki-laki lebih banyak yaitu 20 orang (60,6%), sebagian besar berumur 60-

74 tahun yaitu 29 responden (87,9%), pekerjaan responden yang paling dominan ataupun yang paling banyak adalah pensiunan yaitu sebanyak 20 responden (60,6%), tingkat pendidikan responden yang paling banyak adalah lulusan SMA yaitu sebanyak 15 responden (45,5%), kualitas tidur yang paling banyak adalah kualitas tidur buruk dengan jumlah 19 responden (57,6%), kualitas hidup paling banyak adalah kualitas hidup buruk dengan jumlah 19 responden (57,6%).

Hasil analisis bivariat diketahui responden dengan kualitas tidur baik dan kualitas hidup baik terdiri dari 8 responden (57,1%), sedangkan responden dengan kualitas tidur sedang dan kualitas hidup baik terdiri dari 6 responden (42,9%), sementara responden yang memiliki

kualitas tidur buruk dengan kualitas hidup buruk berjumlah 19 responden (100%). Berdasarkan uji statistic *Chi Square* diperoleh nilai *P-value* (0,000). Hal ini menunjukkan tingkat kemaknaan ($p \leq 0,05$) yang berarti terdapat hubungan yang signifikan antara kualitas tidur dengan kualitas

hidup (Tabel 2). Dengan demikian peneliti menyimpulkan bahwa semakin buruk kualitas tidur seseorang maka semakin rendah pula kualitas hidup orang tersebut. Sebaliknya semakin baik kualitas tidur seseorang maka semakin tinggi pula kualitas hidup orang tersebut.

Tabel 1. Distribusi Frekuensi Karakteristik Responden pada Lansia dengan Diabetes Mellitus Tipe 2 (n=33)

Karakteristik Responden	Frequency (n)	Persentase (%)
Jenis Kelamin		
Laki-Laki	20	60,6
Perempuan	13	39,4
Usia		
60-74 Tahun	29	87,9
75-90 Tahun	4	12,1
Pekerjaan		
Swasta	5	15,2
Ibu Rumah Tangga	8	24,2
Pensiun	20	60,6
Tingkat Pendidikan		
SMP	6	18,2
SMA	15	45,5
S1/S2	12	36,4
Kualitas Tidur		
Baik	8	24,2
Sedang	6	18,2
Buruk	19	57,6
Kualitas Hidup		
Baik	14	42,4
Buruk	19	57,6

Tabel 2. Analisis Hubungan Kualitas Tidur dengan Kualitas Hidup pada Lansia dengan Diabetes Mellitus Tipe 2 (n=33)

Kualitas Tidur	Kualitas Hidup				Total		P-Value
	Baik		Buruk				
	F	%	F	%	F	%	
Baik	8	57,1	0	0	8	100	
Sedang	6	42,9	0	0	6	100	
Buruk	0	0	19	100	19	100	
Total	14	100	19	100	33	100	

PEMBAHASAN

Kualitas tidur lansia yang mengalami DM tipe 2 menjadi salah

satu penentu kualitas hidupnya. Hasil penelitian ini didukung oleh Pereira (2014) yang meneliti hubungan pola tidur dengan kualitas hidup lansia.

Penelitian ini menyimpulkan bahwa ada hubungan korelasional pola tidur dengan kualitas hidup lansia. Seseorang yang memasuki usia lanjut akan mengalami perubahan secara bertahap didalam aktivitas metabolisme organ dan dimulainya ketidakmampuan tubuh dalam meregenerasi sel. Dampak dari perubahan tersebut yaitu lansia mengalami penurunan aspek-aspek dalam kualitas hidup. Salah satu prediktor utama dalam kualitas hidup adalah kesehatan fisik, dimana salah satunya yaitu aspek tidur dan istirahat (Edwina, et.al, 2015; Rachmawati, 2013; Wafy, 2014). Tidur merupakan salah satu fenomena dasar yang penting bagi kehidupan manusia, kurang lebih dari 7 jam kehidupan manusia dijalankan dengan tidur (Gustimigo, 2015). Menurut Tamber (2009) proses degenerasi pada lansia menyebabkan waktu tidur yang efektif semakin berkurang, dan menyebabkan tidak tercapainya kualitas tidur yang adekuat dan menyebabkan berbagai macam keluhan tidur yang dapat mengakibatkan penurunan pada kualitas hidup lansia (Rotie, 2017). Sejalan dengan penelitian Ardinata (2014) diketahui bahwa ternyata kualitas tidur ada hubungannya dengan kesehatan fisik, salah satunya yaitu peningkatan tekanan darah.

Pasien dengan penyakit diabetes melitus, saat tidur malam hari pankreas akan melepaskan secara terus menerus sejumlah kecil insulin bersama dengan hormon pankreas lain yang disebut dengan glukagon. Insulin dan glukagon secara bersama-sama mempertahankan kadar glukosa yang konstan dalam darah dengan menstimulasi pelepasan glukosa dari

hati. Jika kadar glukosa tinggi dalam darah dan jumlah insulin berkurang maka jumlah glukosa yang memasuki sel akan berkurang yang akan menyebabkan produksi glukosa oleh hati menjadi tidak terkendali. Dalam upaya untuk menghilangkan glukosa yang berlebihan dari dalam tubuh, ginjal akan mengekskresikan glukosa bersama air dan elektrolit. Hal inilah yang menyebabkan urinasi yang berlebihan (poliuria) dan panas pada malam hari dan merasakan peningkatan rasa haus (polidipsi) sehingga menyebabkan lansia sering terbangun di malam hari ditambah lagi akibat dari proses degenerasi yang dialami lansia membuatnya susah untuk memulai tidur. Hal inilah yang menyebabkan kualitas tidur pada lansia terganggu yang mengakibatkan terjadinya penurunan pada kualitas hidupnya.

SIMPULAN

Terdapat hubungan yang signifikan antara kualitas tidur dengan kualitas hidup lansia dengan penyakit DM tipe 2. Semakin buruk kualitas tidur lansia maka akan semakin rendah kualitas hidupnya.

SARAN

Lansia yang mempunyai penyakit DM tipe 2 disarankan untuk menjaga kualitas tidurnya agar kualitas hidupnya juga menjadi lebih baik. Sedangkan bagi petugas kesehatan khususnya perawat disarankan untuk memberikan intervensi untuk meningkatkan kualitas tidur pada lansia yang mengalami DM tipe 2. Dengan demikian maka kualitas hidup lansia dapat ditingkatkan menjadi lebih baik.

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Lampiran 9

Hubungan Kualitas Tidur dengan Kualitas Hidup Pada Lansia dengan Penyakit Diabetes Melitus Tipe 2 di Klub Prolanis Sanang Barigas Palangka Raya

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Abstrak

Akhmadi. 2019. *Hubungan Kualitas Tidur dengan Kualitas Hidup pada Lansia dengan Penyakit Diabetes Melitus Tipe 2 di Klub Prolanis Sanang Barigas Palangka Raya*. Skripsi, Program Studi D-IV Keperawatan, Jurusan Keperawatan, Politeknik Kesehatan Kemenkes Palangka Raya.

Pembimbing (I) Berthiana T, S.Pd., M. Kes., (II) Ns. Wijaya Atmaja K, S.Kep., M.Kep., xv + 78 halaman; 9 tabel; 4 gambar.

Latar belakang : Diabetes Melitus merupakan suatu penyakit dengan salah satu tanda dan gejala yaitu sering buang air kecil dalam jumlah banyak pada malam hari yang akan berdampak pada kualitas tidur dan kadar glukosa darah pada pasien diabetes melitus. Tidur yang efektif pada pasien DM sangat dibutuhkan untuk memperbaiki sel-sel yang rusak termasuk sel beta yang berfungsi untuk memproduksi insulin (Julia V. Rottie).

Tujuan : Untuk mengetahui hubungan kualitas tidur dengan kualitas hidup pada lansia dengan penyakit diabetes melitus tipe 2.

Metodologi : Penelitian ini merupakan penelitian deskriptif korelasi dengan pendekatan *cross sectional*. Pemilihan metode deskriptif korelasi dalam penelitian ini didasarkan dari peneliti yang ingin mengkaji dan melihat keeratan hubungan antara dua variabel dan untuk mengetahui arah hubungan yang terjadi dengan jumlah 33 responden dengan teknik pengambilan data dikumpulkan secara simultan atau pada suatu waktu (*point time approach*). Analisa data menggunakan uji *Chi Square (crosstabs)*.

Hasil : Hasil penelitian ini menunjukkan terdapat hubungan yang signifikan antara variabel kualitas tidur dengan kualitas hidup pasien diabetes melitus tipe 2 dengan nilai *P-value* (0,000) atau ($p < 0,05$).

Kesimpulan : Terdapat hubungan antara kualitas tidur dengan kualitas hidup pada lansia dengan penyakit diabetes melitus tipe 2.

Kata kunci: •Kualitas Tidur •Kualitas Hidup •Lansia •Diabetes Melitus Tipe 2

Abstract

Akhmadi. 2019. *Relationship the Sleep Quality with Quality of Life in the Elderly with Type 2 of Diabetes Mellitus in Clubs Prolanis Sanang Barigas Palangkaraya*. Skripsi, D-IV Nursing Program, Department of Nursing, Palangkaraya Health Polytechnic.

Supervisor (I) Berthiana T, S.Pd., M. Kes., (II) Ns. Wijaya Atmaja K, S.Kep., M. Kep., xiv + 78 pages; 9 tables; 4 images.

Background : Diabetes mellitus is a disease with one of the signs and symptoms are frequent urination in large quantities on a night that will have an impact on sleep quality and blood glucose levels in patients with diabetes mellitus. Effective sleep in diabetic patients is needed to repair damaged cells, including beta cells that function to produce insulin (Julia V. Rottie).

Aim : To determine the relationship of the quality of sleep and quality of life in older adults with type 2 diabetes mellitus.

methods: This research is descriptive correlation with cross sectional approach. Selection of correlation descriptive method in this research was based on researchers who want to study and look at the relationship between two variables and to determine the direction of the relationship with the number of 33 respondents to the collected data retrieval techniques simultaneously or at a time (point time approach). Data were analyzed using Chi Square test (crosstabs).

Results: These results indicate a significant relationship between the variable quality of sleep and quality of life of patients with diabetes mellitus type 2 with P-value (0.000) or ($p < 0.05$). **conclusion:** There is a relationship between quality of sleep and quality of life in elderly with type 2 of diabetes mellitus.

Keywords: • Sleep Quality • Quality of Life • Elderly • Type 2 of Diabetes Mellitus

Pendahuluan

Diabetes melitus (DM) merupakan penyakit kronis yang masih menjadi masalah utama dalam dunia kesehatan di Indonesia. DM adalah suatu kelompok penyakit metabolik dengan karakteristik hiperglikemia yang terjadi karena kelainan sekresi insulin, kerja insulin atau kedua-duanya. Lebih dari 90 persen dari semua populasi diabetes adalah diabetes melitus tipe 2 yang ditandai dengan penurunan sekresi insulin karena berkurangnya fungsi sel beta pankreas secara progresif yang

disebabkan oleh resistensi insulin (Soegondo, 2009).

World Health Organization (WHO) (2010), menyatakan saat ini terdapat

366 juta jiwa dengan DM di dunia, di Indonesia pada tahun 2000 sebanyak 8,4 juta jiwa dan akan meningkat menjadi 21,8 juta pada tahun 2030. Berdasarkan studi *International Diabetes Federation* (IDF) pada tahun 2013 penduduk Indonesia yang menderita DM menjadi sekitar 382 juta orang. Indonesia merupakan negara yang menduduki urutan ketujuh dengan penderita

DM terbanyak dengan jumlah penderita DM sebanyak 7,6 juta jiwa dan diperkirakan akan terus meningkat enam persen setiap tahunnya (Rachmaningtyas, 2013).

Hasil Data Riset Kesehatan Dasar (Riskesdas, 2018) di Indonesia tentang penyakit tidak menular mengalami kenaikan jika dibandingkan dari tahun 2013 dan untuk penyakit diabetes mellitus diabetes melitus naik dari 6,9% menjadi 8,5%. Prevalensi diabetes melitus di Indonesia yang sudah terdiagnosis oleh dokter adalah sebanyak

1.017.290 jiwa dan sepertinya akan terus meningkat. Untuk Kalimantan Tengah sendiri prevalensi diabetes melitus yang sudah berhasil masuk catatan rekam medis dokter berjumlah 10.189 penderita. Di kota Palangaka Raya penyandang diabetes yang datang dan berobat kepuskesmas meningkat cukup tajam dalam 6 tahun terakhir, jika pada tahun 2006 di laporkan sebanyak 379 penderita. Maka pada akhir 2016 sebanyak

1.372 penderita pada tahun 2017 meningkat tajam sebanyak 3,228 penderita (Profil Kesehatan Kota Palangka Raya Tahun 2017).

Dalam rangka meningkatkan kesehatan masyarakat serta menyukseskan program jaminan sosial bidang kesehatan, sesuai dengan peraturan presiden nomor 12 tahun 2013 tentang jaminan kesehatan pasal

21 ayat 1, salah satu manfaat yang didapatkan peserta BPJS kesehatan adalah pelayanan kesehatan promotif dan preventif untuk menjaga agar masyarakat tetap sehat, salah satunya adalah program pengelolaan penyakit kronis (prolanis). Prolanis merupakan sistem pelayanan kesehatan dan pendekatan proaktif yang dilaksanakan secara integritas yang melibatkan peserta fasilitas kesehatan tingkat pertama (FKTP) dan BPJS kesehatan. FKTP bertanggung jawab untuk melaksanakan program pencegahan melalui senam prolanis, pemantauan kadar gula darah, dan memberi edukasi tentang diabetes melitus (Idris, 2014).

Diabetes melitus tipe 2 merupakan gangguan metabolik dimana insulin ada namun jumlah nya tidak dapat mencukupi atau reseptor insulin tidak dapat berespon terhadap insulin (Lewis, 2014). Pada klien dengan DM terdapat tiga gejala klasik yakni, polyuria (banyak kencing), polydipsia (banyak minum) dan polyphagia (banyak makan). Selain itu terdapat beberapa gejala lain seperti sering mengantuk, gatal-gatal terutama di daerah kemaluan, pandangan mata kabur, mati rasa atau rasa sakit pada bagian tubuh bagian bawah, infeksi kulit, cepat naik darah, sangat lemah atau cepat lelah, dan mual muntah (Novitasari, 2012).

Sifat alamiah dari penyakit dapat mencegah individu untuk mendapatkan istirahat yang cukup (Potter & Perry, 2013). Pasien dengan kondisi penyakit kronik seperti DM akan lebih sering mengalami insomnia, dikarenakan kadar gula darah yang tinggi sangat mengganggu konsentrasi untuk tidur nyenyak. Hasil penelitian Jessy Kurnia, Mulyadi, dan Julia V. Rottie (2017) tentang hubungan kualitas tidur dengan kadar glukosa darah puasa pada pasien diabetes melitus tipe 2, didapatkan hasil yang menunjukkan peningkatan kadar gula darah puasa pada pasien diabetes melitus tipe 2 yang memiliki kualitas tidur yang buruk.

Kualitas tidur adalah kepuasan seseorang terhadap tidur, sehingga seseorang tersebut tidak memperlihatkan perasaan lelah, mudah terangsang dan gelisah, lesu dan apatis, kehitaman di sekitar mata, kelopak mata bengkak, konjungtiva merah, mata perih, perhatian terpecah-pecah, sakit kepala dan sering menguap atau mengantuk (Budiatri et al, 2013).

Gangguan-gangguan tidur yang terjadi pada penderita DM akan menyebabkan penurunan pada kualitas hidupnya. Pasien yang menderita penyakit DM yang menjalani terapi pengobatan dapat

mempengaruhi kapasitas fungsional, psikologis dan kesehatan sosial serta mempengaruhi kesejahteraannya yang didefinisikan sebagai kualitas hidup atau quality of life (QoL) (Wimpie, 2007). Quality of Life adalah kondisi dimana pasien yang menderita penyakit yang sedang dideritanya dapat tetap merasa nyaman secara fisik, psikologis, sosial maupun spiritual serta secara optimal memanfaatkan hidupnya untuk kebahagiaan dirinya maupun orang lain. Rata-rata pasien penyandang DM umumnya mengalami gangguan kualitas tidur, dikarenakan sering terbangun di malam hari untuk buang air kecil atau merasa haus sehingga kualitas tidurnya terganggu. Gangguan kualitas tidur tersebut jika terus berkelanjutan akan berdampak pada penurunan kualitas hidup pasien penyandang DM (Fitri, 2015).

Dwi Rahayu Yuliyanti (2015) melakukan sebuah penelitian untuk mengetahui hubungan dukungan keluarga dengan kualitas hidup lansia. Berdasarkan penelitian tersebut diketahui bahwa terdapat hubungan yang bermakna antara hubungan dukungan keluarga dengan kualitas hidup lansia. Dimana dari hasil penelitian tersebut menunjukkan dukungan keluarga yang tinggi pada lansia sebagian besar kualitas hidupnya baik, sedangkan dukungan

keluarga yang rendah pada lansia sebagian besar kualitas hidupnya buruk.

Pengukuran kualitas hidup bersifat multidimensi yang meliputi fungsi fisik, psikologis, sosial, lingkungan dan kualitas hidup secara umum. Pengukuran kualitas hidup bisa dilakukan dengan menggunakan kuesioner yang dikembangkan oleh WHO. Para penderita DM dikatakan memiliki hidup yang berkualitas apabila mereka memiliki kondisi fungsional yang optimal, sehingga mereka dapat menikmati kehidupannya dengan penuh makna, membahagiakan dan berguna. Gangguan kualitas tidur pada lansia yang menderita DM dapat mempengaruhi kualitas hidup lansia tersebut seperti kualitas hidup yang buruk, fisik, emosi, dan sosial.

Metode

Penelitian ini merupakan penelitian deskriptif korelasi dengan pendekatan *cross sectional*. Pemilihan metode deskriptif korelasi dalam penelitian ini didasarkan dari peneliti yang ingin mengkaji dan melihat keeratan hubungan antara dua variabel dan untuk mengetahui arah hubungan yang terjadi dengan jumlah 33 responden dengan teknik pengambilan data dikumpulkan secara simultan atau pada suatu waktu (*point time approach*). Analisa data dilakukan

dengan analisa univariat dan bivariat, dan hipotesis yang diajukan diuji kebenarannya melalui analisis tersebut. Ho akan diuji dengan tingkat kemaknaan 0,1. Uji statistik yang digunakan adalah analisis statistik *Chi Square (crosstabs)*.

Hasil

Analisis Univariat

Tabel 4.1 Distribusi frekuensi karakteristik responden berdasarkan jenis kelamin Pada Lansia Dengan Diabetes Melitus Tipe 2 Di Prolanis Sanang Barigas Palangka Raya (n=33)

Karakteristik Responden	Jumlah (f)	Persen (%)
Jenis Kelamin		
a. Laki-laki	20	60,6
b. Perempuan	13	39,4
Total	33	100

Berdasarkan jenis kelamin tabel 4.1 diketahui bahwa dari 33 responden yang diteliti penderita diabetes melitus yang berjenis kelamin laki-laki lebih banyak yaitu

20 orang (60,6%), sedangkan penderita diabetes melitus yang berjenis kelamin perempuan berjumlah 13 orang (39,4%).

Tabel 4.2 Distribusi frekuensi karakteristik responden berdasarkan umur Pada Lansia Dengan Diabetes Melitus Tipe 2 Di Prolanis Sanang Barigas Palangka Raya (n=33)

Karakteristik Responden	Jumlah (f)	Persen (%)
Umur		
60-74 tahun	29	87,9
75-90 tahun	4	12,1
Total	33	100

Berdasarkan tabel 4.2 diketahui bahwa dari 33 responden yang diteliti sebagian besar berumur 60-74 tahun yaitu 29 responden (87,9%).

Tabel 4.3 Distribusi Frekuensi Karakteristik Responden Berdasarkan Pekerjaan Pada Lansia Dengan Diabetes Melitus Tipe 2 Di Prolanis Sanang Barigas Palangka Raya (n=33)

Karakteristik Responden	Jumlah (f)	Persen (%)
Pekerjaan		
Swasta	5	15,2
IRT	8	24,2
Pensiunan	20	60,6
Total	33	100

Berdasarkan pekerjaan dilihat dari tabel 4.3 menunjukkan bahwa dari jumlah 33 responden yang dilihat dari pekerjaannya, maka pekerjaan responden yang paling dominan ataupun yang paling banyak adalah pensiunan yaitu sebanyak 20 responden (60,6%), di ikuti responden dengan yang bekerja sebagai IRT sebanyak 8 responden (24,2%), dan responden yang bekerja sebagai swasta sebanyak 5 responden (15,2%).

Tabel 4.4 Distribusi frekuensi karakteristik responden berdasarkan pendidikan terakhir Pada Lansia Dengan Diabetes Melitus Tipe 2 Di Prolanis Sanang Barigas Palangka Raya (n=33)

Karakteristik Responden	Jumlah (f)	Persen (%)
Pendidikan terakhir		
SMP	6	18,2
SMA	15	45,5
S1/S2	12	36,4
Total	33	100

Berdasarkan Pendidikan terakhir dilihat dari tabel 4.4 menunjukkan bahwa dari jumlah 33 responden yang dilihat dari Pendidikan terakhir, maka tingkat pendidikan responden yang paling dominan ataupun yang paling banyak adalah lulusan SMA yaitu sebanyak 15 responden (45,5%), di ikuti responden lulusan S1/S2 sebanyak 12

responden (36,4%), dan responden lulusan SMP sebanyak 6 responden (18,2 %).

Tabel 4.5 Distribui frekuensi kualitas tidur responden Pada Lansia Dengan Diabetes Melitus Tipe 2 Di Prolanis Sanang Barigas Palangka Raya (n=33)

Kualitas Tidur	Jumlah (f)	Persen (%)
Baik	8	24,2
Sedang	6	18,2
Buruk	19	57,6
Total	33	100,0

Berdasarkan kualitas tidur dilihat dari tabel

45 menunjukkan bahwa dari 33 responden yang dilihat dari kualitas tidurnya, maka responden yang paling dominan ataupun yang paling banyak adalah kualitas tidur buruk dengan jumlah 19 responden (57,6%), di ikuti responden dengan kualitas tidur baik dengan jumlah 8 responden (24,2%), dan responden dengan kualitas tidur sedang dengan jumlah 6 responden (18,2%).

Tabel 4.6 Distribusi frekuensi kualitas hidup responden Pada Lansia Dengan Diabetes Melitus Tipe 2 Di Prolanis Sanang Barigas Palangka Raya (n=33)

Kualitas Hidup	Jumlah (f)	Persen (%)
Baik	14	42,4
Buruk	19	57,6
Total	33	100,0

Berdasarkan kualitas hidup dilihat dari tabel

46 menunjukkan bahwa dari 33 responden yang dilihat dari kualitas hidup, maka responden yang paling dominan ataupun yang paling banyak adalah kualitas hidup buruk dengan jumlah 19 responden (57,6%), dan

sebaliknya responden yang kualitas hidup baik berjumlah 14 responden (42,4%).

Analisis Bivariat

Tabel 4.7 Analisis Hubungan Kualitas Tidur Dengan Kualitas Hidup Pada Lansia Dengan Diabetes Melitus Tipe 2 Di Prolanis Sanang Barigas Palangkaraya (n=33)

<u>Kualitas Tidur</u>	<u>Kualitas Hidup</u>						<i>P-value</i>
	<u>Baik</u>		<u>Buruk</u>		<u>Total</u>		
	F	%	F	%	F	%	
<u>Baik</u>	8	57,1	0	0,0	8	100	0,000
<u>Sedang</u>	6	42,9	0	0,0	6	100	
<u>Buruk</u>	0	0	19	100	19	100	
<u>Total</u>	14	100	19	100	33	100	

Berdasarkan tabel 4.7 menunjukkan responden dengan kualitas tidur baik dan kualitas hidup baik terdiri dari 8 responden (57,1%), sedangkan responden dengan kualitas tidur sedang dan kualitas hidup baik terdiri dari 6 responden (42,9%), sementara responden yang memiliki kualitas tidur buruk dengan kualitas hidup buruk berjumlah 19 responden (100%). Berdasarkan uji statistic Chi Square diperoleh nilai P-value (0,000). Hal ini menunjukan tingkat kemaknaan ($p \leq 0,05$) yang berarti terdapat hubungan yang signifikan antara kualitas tidur dengan kualitas hidup. Berdasarkan uraian diatas, peneliti menyimpulkan bahwa semakin buruk kualitas tidur seseorang maka semakin rendah pula kualitas hidup orang tersebut. Sebaliknya semakin baik kualitas tidur seseorang maka semakin tinggi pula kualitas hidup orang tersebut.

Pembahasan

Responden dalam penelitian ini adalah Anggota Prolanis Sanang Barigas Palangka Raya yang berjumlah 33 responden. Sebagian besar berjenis kelamin laki-laki sebanyak 20 responden (60,4%) dan perempuan sebanyak 13 responden (39,4%). Menurut Ahmad, Alghadir, dkk (2012), bahwa prevalensi terjadinya diabetes melitus lebih tinggi pada perempuan dibandingkan dengan laki-laki. Tetapi pada Klub Prolanis Sanang Barigas Palangka Raya lansia yang menderita diabetes melitus tipe 2 didominasi oleh laki-laki sehingga jumlah lansia yang menderita diabetes melitus lebih banyak laki-laki dibandingkan perempuan.

Umur responden pada penelitian ini yaitu lansia yang berumur >60 tahun, sebanyak 33 responden. Sejalan dengan hasil penelitian Kekenusa (2013) menunjukkan bahwa terdapat hubungan bermakna antara umur dengan kejadian DM Tipe 2 dan menyatakan bahwa orang dengan umur ≥ 45 tahun memiliki resiko 8 kali lebih besar terkena penyakit DM Tipe 2 dibandingkan dengan orang yang berumur kurang dari 45 tahun. Umur merupakan faktor yang mempengaruhi pada orang dewasa, dengan semakin bertambahnya

umur kemampuan jaringan mengambil glukosa darah semakin menurun (Suiraoaka, 2016).

Berdasarkan jenis pekerjaan responden hasil penelitian menunjukkan sebagian besar responden adalah pensiunan PNS yaitu sebanyak 20 responden (60,6%),

IRT sebanyak 8 responden (24,2%), dan

swasta sebanyak 5 responden (15,2%).

Pembahasan tentang jenis pekerjaan khususnya pada pasien DM tipe 2 berkaitan dengan aktivitas sehari-hari, sehingga hal tersebut dapat mengurangi resiko terjadi komplikasi seperti gangguan kardiovaskuler dan meningkatkan harapan hidup serta meningkatkan rasa nyaman baik secara fisik, psikologis maupun sosial (Soegondo, 2009).

Gambar tingkat pendidikan ini berdasarkan

riwayat pendidikan formal terakhir yang diikuti responden. Hasil analisis menunjukkan bahwa sebagian besar responden berpendidikan SMA yaitu sebanyak 15 responden (45,5%), lainnya yang berpendidikan S-1/S-2 sebanyak 12 responden (36,4%), dan yang berpendidikan SMP sebanyak 6 orang (18,2%). Dengan latar belakang

pendidikan responden setingkat SMA/lebih, maka diharapkan akan lebih mudah dalam menerima informasi yang terkait dengan penatalaksanaan DM tipe 2 dan mencegah timbulnya komplikasi.

Identifikasi tingkat pendidikan berkaitan dengan penatalaksanaan DM khususnya tentang edukasi. Program edukasi memiliki peran yang sangat besar dalam meningkatkan pengetahuan, pemahaman dan kemampuan pasien dalam mencegah komplikasi diabetes melitus tipe 2 (Soegondo, 2009).

Berdasarkan hasil distribusi frekuensi dan persentase berdasarkan kategori tingkat kualitas tidur di Klub Prolanis Sanang Barigas Palangka Raya, dilihat dari tabel 4.5 menunjukkan bahwa dari 33 responden yang dilihat dari kualitas tidurnya, maka responden yang paling dominan ataupun yang paling banyak adalah kualitas tidur buruk dengan jumlah 19 responden (57,6%), di ikuti responden dengan kualitas tidur baik dengan jumlah 8 responden (24,2%), dan responden dengan kualitas tidur sedang dengan jumlah 6 responden (18,2%). Dimana mayoritas responden mengatakan sulit untuk memulai tidur, merasakan panas di malam hari, sering terbangun di malam hari dan semua responden tidak membutuhkan obat untuk memulai tidur.

Distribusi frekuensi responden berdasarkan kualitas hidup dilihat dari tabel 4.6 menunjukkan bahwa dari 33 responden yang dilihat dari kualitas hidup, maka

responden yang paling dominan ataupun yang paling banyak adalah kualitas hidup buruk dengan jumlah 19 responden (57,6%), dan sebaliknya responden yang kualitas hidup baik berjumlah 14 responden (42,4%). Menurut Yudianto, (2008) menjelaskan kualitas hidup (quality of life) adalah persepsi pribadi seseorang akan hidupnya berdasarkan nilai dan kepercayaan personal yang mencakup semua area kehidupan seperti komponen lingkungan dan materil, komponen fisik, mental dan sosial.

Berdasarkan tabel 4.7 diatas menunjukkan responden dengan kualitas tidur baik dan kualitas hidup baik terdiri dari 8 responden (57,1%), sedangkan responden dengan kualitas tidur sedang dan kualitas hidup baik terdiri dari 6 responden (42,9%), sementara responden yang memiliki kualitas tidur buruk dengan kualitas hidup buruk berjumlah 19 responden (100%). Berdasarkan uji statistik diperoleh nilai P (value) 0,000. Hal ini menunjukan tingkat kemaknaan ($p \leq 0,05$) yang berarti terdapat hubungan yang signifikan antara kualitas tidur dengan kualitas hidup. Hasil penelitian ini didukung oleh Pereira (2014) yang meneliti hubungan pola tidur dengan kualitas hidup lansia. Penelitian ini menyimpulkan bahwa ada hubungan

korelasional pola tidur dengan kualitas hidup lansia.

Pada kasus pasien dengan penyakit diabetes melitus, saat tidur malam hari pankreas akan melepaskan secara terus menerus sejumlah kecil insulin bersama dengan hormon pankreas lain yang disebut dengan glukagon. Insulin dan glukagon secara bersama-sama mempertahankan kadar glukosa yang konstan dalam darah dengan menstimulasi pelepasan glukosa dari hati. Jika kadar glukosa tinggi dalam darah dan jumlah insulin berkurang maka jumlah glukosa yang memasuki sel akan berkurang yang akan menyebabkan produksi glukosa oleh hati menjadi tidak terkendali. Dalam upaya untuk menghilangkan glukosa yang berlebihan dari dalam tubuh, ginjal akan mengekskresikan glukosa bersama air dan elektrolit. Hal inilah yang menyebabkan urinasi yang berlebihan (poliuria) dan panas pada malam hari dan merasakan peningkatan rasa haus (polidipsi) sehingga menyebabkan lansia sering terbangun di malam hari ditambah lagi akibat dari proses degenerasi yang dialami lansia membuatnya susah untuk memulai tidur. Hal inilah yang menyebabkan kualitas tidur pada lansia terganggu yang mengakibatkan terjadinya penurunan pada kualitas hidupnya.

Kesimpulan

Berdasarkan hasil penelitian yang telah dilakukan di Klub Prolanis Sanang Barigas Palangka Raya maka dapat disimpulkan bahwa dari total 33 responden, mayoritas penyandang DM berjenis kelamin laki-laki yaitu 20 orang (60,6%). Sementara itu untuk umur lebih dominan pada rentang 60-74 tahun yaitu sebanyak 29 responden (87,9%). Pada penelitian ini pendidikan terakhir lansia paling banyak yaitu lulusan SMA sebanyak 15 responden (45,5%), dan pekerjaan lansia yang paling banyak adalah pensiunan yaitu sebanyak 20 responden (60,6%). Sementara itu dari 33 responden yang diteliti, rata-rata kualitas tidur responden buruk dengan jumlah 19 responden (57,6%), dan responden dengan kualitas hidup buruk dengan jumlah 19 responden (57,6%).

Analisis menunjukkan terdapat hubungan antara kualitas tidur dengan kualitas hidup pada lansia dengan nilai P-value 0,000 atau $P \leq 0,05$. Hal ini menunjukkan tingkat kemaknaan yang berarti dapat disimpulkan bahwa ada Hubungan Kualitas Tidur dengan Kualitas Hidup pada Lansia dengan Penyakit Diabetes Melitus Tipe 2 Di Klub Prolanis Sanang Barigas Palangka Raya Tahun 2019.

Saran

Mengacu dari hasil penelitian yang telah dilakukan, ada beberapa saran yang diajukan dan diharapkan menjadi bahan pertimbangan.

1. Bagi Institusi Pendidikan Poltekkes Kemenkes Palangka Raya

Bagi Institusi pendidikan hasil penelitian ini dapat dijadikan sebagai bahan pembelajaran khususnya dibidang keperawatan terkait diabetes melitus dan sebagai bahan literatur di perpustakaan Poltekkes Kemenkes Palangka Raya, sehingga dapat dijadikan sebagai bahan acuan bagi penelitian yang akan dilakukan pada masa mendatang.

2. Bagi Prolanis Sanang Barigas Palangka Raya

Hasil penelitian ini dapat digunakan untuk pelayanan kesehatan di Klub Prolanis Sanang Barigas Palangka Raya sebagai informasi dalam pemberian edukasi kepada penyandang

diabetes melitus tipe 2 terutama pada lansia.

3. Bagi Lansia Penderita Diabetes Melitus

Lansia hendaknya senantiasa mengikuti program-program yang direncanakan oleh pemerintah untuk menjaga kualitas tidur dan kualitas hidup lansia, misalnya kegiatan posyandu lansia dan klub Prolanis. Keaktifan lansia dalam program tersebut diharapkan dapat meningkatkan kualitas tidur dan kualitas hidup lansia dengan terkontrolnya kondisi kesehatan lansia.

4. Bagi penelitian selanjutnya

Penelitian ini dapat menjadi referensi bagi penelitian lain yang ingin melakukan penelitian dengan objek sejenis. Namun diharapkan peneliti yang akan datang meningkatkan jumlah populasi ataupun jumlah variable penelitian, sehingga diketahui faktor apakah yang paling dominan

berhubungan kualitas tidur dengan kualitas hidup pada lansia dengan penyakit diabetes melitus tipe 2.

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Lampiran 10



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Association of the combination of sleep duration and sleep quality with quality of life in type 2 diabetes patients

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Abstract

Purpose Sleep problems are very common in people with diabetes. The aim of this study was to assess the association of the combination of self-reported sleep duration and sleep quality on quality of life (QOL) in Chinese patients with type 2 diabetes mellitus (T2DM).

Methods We analyzed the community-based cross-sectional data of 798 patients with T2DM in Xiamen, China, in 2016. Sleep duration was measured as self-reported average sleep time during the previous month. Sleep quality was evaluated as self-rated reports. QOL was assessed by the Diabetes-specific Quality of Life (DSQL), with scores < 40 and ≥ 80 set as cut-off values for differentiating good, fair, and poor QOL. Ordinal logistic regression was performed to model the associations of QOL with sleep duration, sleep quality, and their combined effects by adjusting for certain covariates.

Results The separate associations of sleep duration and sleep quality in relation to QOL in T2DM patients were significant ($P < 0.05$). After controlling for sleep quality, there was no significant correlation between sleep duration and QOL. The combined analysis suggested that the association of sleep duration with QOL in T2DM patients was sleep quality-dependent. Longer sleep duration was associated with higher odds ratios (ORs) of better QOL for patients who reported fair sleep quality and good sleep quality, but no such trend was observed for patients who reported poor sleep quality ($P > 0.05$). Excessive sleep duration (≥ 9 h per day) was detrimental to QOL in T2DM only when they reported poor sleep quality.

Conclusions Specific disparities exist in the association of sleep quality with sleep duration and QOL in T2DM patients. Failures to take into account the effect of sleep quality when evaluating the impact of sleep on QOL significantly bias the results. It is important to integrate duration and quality of sleep as a composite sleep index when assessing sleep of patients with T2DM.

Keywords Sleep duration · Sleep quality · Association of the combination · Quality of life · Type 2 diabetes

Introduction

With the rise in the older population and unhealthy lifestyles, diabetes has become one of the primary risk factor for death worldwide, especially in China [1]. The International Diabetes Federation (IDF) estimated that the number of people with diabetes in China reached 114.4 million in 2017, with type 2 diabetes mellitus (T2DM) being predominant [2]. Compared with the general population, people with T2DM report poorer quality of life (QOL) due to functional decline and disability [3–5]. QOL is one of the most important indexes in individuals with T2DM, as it reflects the physical and social function as well as the emotional health. Therefore, improvements in QOL represent a major goal of health interventions. Even more compelling evidence of this association was provided by a prospectively followed cohort

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study that revealed a strong relation between worse QOL and mortality in patients with T2DM [6].

Previous studies have indicated that QOL in adults with T2DM can be significantly influenced by certain medical interventions and by lifestyle and educational interventions, such as insulin use, glycemic control, smoking cessation, weight control, and psychologically health [7–12]. Insufficient sleep and poor sleep quality are very common in people with T2DM [13–15]. Even after controlling for age, race, education, body mass index (BMI), and diabetes-related distress, poor sleep is significantly correlated with worse QOL in T2DM [16].

Sleep, as a part of a healthy lifestyle, plays an important role in sustaining good health. Sufficient sleep of good quality plays an important and effective role in preventing mental disorders, chronic health conditions, and cardiovascular disease and even death [17]. Although ethnic differences in the risk of poor sleep are frequently reported [18], sleep duration and sleep quality have not been well studied in the Chinese T2DM population. Furthermore, there is increasing evidence that the effectiveness of strategies for the prevention and control of T2DM varies with ethnicity [19, 20]. However, many studies have failed to consider the potential interaction between the duration and quality of sleep.

People with enough sleep usually experience good sleep quality [21]. When analyzing the correlation between diabetes and sleep, it is insufficient to consider sleep duration alone and the individual and combined effects of sleep duration and sleep quality on QOL in T2DM patients remain to be established.

Therefore, using the data from a representative cross-sectional survey conducted in Xiamen, China, we assessed the separated associations of self-reported sleep duration and quality with QOL in T2DM patients. Furthermore, the association of the combination of sleep duration and sleep quality on diabetes-specific QOL was explored.

Materials and methods

Study population

We carried out a cross-sectional survey among five sub-districts in Xiamen, China, in 2016. In total, 800 T2DM patients aged 18+ years who were local residents were enrolled in the study using a multi-stage stratified sampling procedure. Using a self-designed questionnaire, patient information (sociodemographic characteristics, living habits, and quality of life) was obtained through face-to-face interviews. Complete data were obtained for 798 patients.

Quality of life assessment

The main primary outcome in the present study was the diabetes-specific QOL measured according to the Diabetes-specific Quality of Life (DSQL), which is a validated scale designed for Chinese patients with T2DM [22]. The Cronbach's alpha of DSQL is 0.95, and the split-half reliability of DSQL is 0.91. The scale consists of 24 questions with four dimensions which reflect the QOL status of patients in terms of physiology, psychology, sociology, and therapy. The sum of DSQL scores ranges from 24 to 120 points, higher scores represent poorer QOL. The DSQL scores were classified as follows: 'poor QOL (≥ 80),' 'fair QOL (40–79),' and 'good QOL (< 40).'

Key variables

The factors of interest were sleep duration and sleep quality. Information on sleep duration was obtained from the responses to questions about usual sleep duration per day (including night and daytime sleep). The results for sleep duration were rounded up to the nearest whole hour classified as follows: ' ≤ 6 h per day', '7–8 h per day' (reference group), and ' ≥ 9 h per day.' We further considered sleep quality as a potential modifier of the association between sleep duration and QOL. Information on sleep quality was measured by asking 'What is the quality of your sleeping recently?' with the choice of five different answers: 'poor,' 'rather poor,' 'fair,' 'rather good,' and 'good.' We further categorized sleep quality as 'poor sleep quality (poor or rather poor; reference group),' 'fair sleep quality (fair),' and 'good sleep quality (rather good or good).' The covariates in the study included demographic characteristics, early-life health behaviors, type of medication, comorbidities, complications, and hemoglobin A1c (HbA1c) levels. Demographic characteristics included sex, age educational level, and BMI. Early-life health behaviors included smoking and drinking (alcohol) habits. As diabetes duration plays a major role in the QOL of diabetes patients [23, 24], we also evaluated the effects of both sleep duration and sleep quality in relation to different diabetes duration classified as follows: '< 5 years' (reference group), '5–10 years', and '> 10 years.'

Statistical analysis

First, we summarized the characteristics of the T2DM patients according to QOL status using Chi-squared tests. Ordinal logistic regressions were then performed without considering the interactions and QOL status was then modeled according to diabetes duration only, sleep duration only, sleep quality only, diabetes duration and sleep duration,

diabetes duration and sleep quality adjusting for the covariates mentioned previously (models 1–6, respectively). Finally, in model 7, we further considered the interaction of the two sleep parameters (duration and quality). ORs were calculated using the function for linear combinations of coefficients, where the sleep duration ‘7–8 h per day’ and poor sleep quality were viewed as reference categories. All the analyses were performed using SAS V.9.4 (SAS Institute Inc., Cary, North Carolina, USA).

The seven regression models were expressed as follows:

Model 1: $\text{logit (QOL)} \sim \text{Diabetes duration} + \text{covariates}$; Model 2: $\text{logit (QOL)} \sim \text{Sleep duration} + \text{covariates}$; Model 3: $\text{logit (QOL)} \sim \text{Sleep quality} + \text{covariates}$; Model 4: $\text{logit (QOL)} \sim \text{Diabetes duration} + \text{sleep duration} + \text{covariates}$; Model 5: $\text{logit (QOL)} \sim \text{Diabetes duration} + \text{sleep quality} + \text{covariates}$; Model 6: $\text{logit (QOL)} \sim \text{Diabetes duration} + \text{sleep duration} + \text{sleep quality} + \text{covariates}$; Model 7: $\text{logit (QOL)} \sim \text{Diabetes duration} + \text{sleep duration} + \text{sleep quality} + \text{sleep duration} \times \text{sleep quality} + \text{covariates}$;

Results

Basic characteristics of T2DM patients

The basic characteristics of the 798 diabetes patients included in this study are shown according to the QOL in Table 1. As diabetes duration advanced, the diabetes-specific QOL increased ($P = 0.001$). The patients who were female with longer sleep duration, better sleep quality, and suffered from fewer comorbidities and complications presented significantly higher rates of better QOL. Furthermore, those who reported no medication use or ‘pills only’ showed better QOL.

Separated association of sleep duration and quality with QOL in T2DM patients

The ORs of QOL across different levels of diabetes duration, sleep duration, and sleep quality are shown in Table 2. As expected, ORs of better QOL decreased as diabetes duration increased in all the models in which diabetes duration was considered as a predictor (models 1, 4, 5, and 6). Furthermore, ORs of better QOL increased as sleep quality improved in all the models in which sleep quality was considered as a predictor (models 3, 5, and 6). This trend was consistent in model 2 and model 4 when the sleep duration improved. However, after controlling for sleep quality, there

was no significant correlation between sleep duration and QOL in model 6.

Association of the combination of sleep duration and quality with QOL in T2DM patients

The interaction of sleep duration and sleep quality was included in model 7 (Table 3). Patients who reported ‘7–8 h per day’ sleep duration and poor sleep quality were set as the reference group. In general, better sleep quality was associated with higher ORs of better QOL among diabetes patients with the same sleep duration. In addition, longer sleep duration was associated with higher ORs of better QOL among patients who reported fair and good sleep quality, but no such trend was observed for patients who reported poor sleep quality ($P > 0.05$). Among all the groups, poor sleep quality with ‘ ≥ 9 h per day’ sleep duration had the least ORs of better QOL, although this association is failed to reach the level of statistical significance (ORs 0.16, 95% CI 0.01–1.71).

Discussion

In this cross-sectional survey, the total rate of good QOL was only 12.03% among a population of local household-registered adults with T2DM in Xiamen, China. The low QOL score among patients with T2DM identified in the current study is consistent with previous findings in China and other countries [7, 22].

In an effort to improve the QOL of T2DM patients in Chinese adults, the association of the separation and combination of sleep duration and sleep quality with the QOL were assessed, when controlling for diabetes duration, sex, age, educational level, BMI, smoking and drinking (alcohol) habits, type of medication, comorbidities, complications, and HbA1c level as potential confounders. Longer sleep duration and good sleep quality were separately found to be associated with good QOL. Moreover, assessment of the combined effects of sleep duration and sleep quality on QOL in the current study suggested the existence of sleep quality-specific disparities in the association between sleep duration and QOL in T2DM patients. These findings suggest that sleep duration as well as sleep quality exert a combined influence on diabetes-specific QOL.

In the current study, we found that nearly half (49.12%) of the diabetes patients reported the extremes of sleep duration (≤ 6 or ≥ 9) and more than a half (60.3%) of the patients had sleep quality problems. Previous studies have shown that 45–67% of T2DM patients suffer from poor sleep [25–27]. Furthermore, a national survey conducted in China in 2013 showed that 49.3% of T2DM patients reported poor sleep quality [28]. Poor sleep is associated with problems of mobility, pain/discomfort, and anxiety/depression [29–31].

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Table 1 Basic characteristics of 798 diabetes patients according to the quality of life

Characteristic	Diabetes-specific quality of life			χ^2	P value
	Poor	Fair	Good		
Total, N (%)	35 (4.39)	667 (83.58)	96 (12.03)	3.83	0.05
Sex, N (%)					
Female	11 (3.11)	294 (83.05)	49 (13.84)	0.71	0.399
Age group (years), N (%)	24 (5.41)	373 (84.01)	47 (10.59)	0.65	0.420
Male					
< 60	12 (5.31)	189 (83.63)	25 (11.06)		
≥ 60	23 (4.02)	478 (83.57)	71 (12.41)	0.06	0.814
Educational level, N (%)					
None/primary	13 (4.63)	236 (83.99)	32 (11.39)		
Secondary	17 (4.43)	322 (83.85)	45 (11.72)		
Tertiary	5 (3.76)	109 (81.95)	19 (14.29)	0.93	0.335
BMI (kg/m ²), N (%)					
Underweight (< 18.5)	1 (4.55)	20 (90.91)	1 (4.55)		
Normal (18.5–23.0)	12 (4.17)	240 (83.33)	36 (12.50)		
Overweight (> 23.0–27.0)	13 (3.69)	296 (84.09)	43 (12.22)		
Obese (> 27)	9 (6.62)	111 (81.62)	13 (11.76)	0.96	0.328
Smoking habit, N (%)					
Smoker	5 (3.52)	117 (82.39)	20 (14.08)		
Non-smoker	30 (4.57)	550 (83.84)	76 (11.59)	11.70	<0.001***
Alcohol drinking, N (%)					
Drinker	3 (2.31)	110 (84.62)	17 (13.08)		
Non-drinker	32 (4.79)	557 (83.38)	79 (11.83)	15.39	<0.001***
Duration of diabetes (years), N (%)					
< 5	9 (3.49)	205 (79.46)	44 (17.05)		
5–10	6 (2.48)	210 (86.78)	26 (10.74)		
> 10	20 (6.71)	252 (84.56)	26 (8.72)	32.18	<0.001***
Sleep duration (hours), N (%)					
≤ 6	22 (7.36)	252 (84.28)	25 (8.36)		
7–8	12 (2.96)	340 (83.74)	54 (13.30)		
≥ 9	1 (1.08)	75 (80.65)	17 (18.28)	22.50	<0.001***
Sleep quality, N (%)					
Poor	22 (10.53)	176 (84.21)	11 (5.26)		
Fair	8 (2.92)	232 (84.67)	34 (12.41)		
Good	5 (1.59)	259 (82.22)	51 (16.19)	19.29	<0.001***
Type of medication, N (%)					
None	1 (3.33)	18 (60.00)	11 (36.67)		
Pills only	15 (2.94)	431 (84.34)	65 (12.72)		
Insulin only	4 (12.12)	25 (75.76)	4 (12.12)		
Pills and insulin	15 (6.70)	193 (86.16)	16 (7.14)	38.61	<0.001***
Comorbidities, N (%)					
None	8 (2.56)	251 (80.19)	54 (17.25)		
1–2 diseases	18 (4.92)	312 (85.25)	36 (9.84)		
≥ 3 diseases	9 (7.56)	104 (87.39)	6 (5.04)	38.61	<0.001***
Complications, N (%)					
None	11 (1.94)	469 (82.86)	86 (15.19)		
≥ 1	24 (10.34)	198 (84.34)	10 (4.31)		

Table 2 Odds ratios (95% confidence intervals (CI)) obtained from multivariable adjusted ordinal logistic models (models 1–6)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Diabetes duration						
< 5 years	1.00			1.00	1.00	1.00
5–10 years	0.83 (0.51, 1.35)			0.83 (0.51, 1.35)	0.88 (0.54, 1.43)	0.86 (0.53, 1.41)
> 10 years	0.58 (0.35, 0.96)			0.59 (0.36, 0.98)	0.60 (0.36, 0.99)	0.60 (0.36, 0.99)
Sleep duration						
≤ 6 h		0.55 (0.36, 0.85)		0.56 (0.36, 0.87)		0.80 (0.50, 1.28)
7–8 h		1.00		1.00		1.00
≥ 9 h		1.47 (0.81, 2.64)		1.49 (0.83, 2.70)		1.40 (0.77, 2.56)
Sleep quality						
Poor			1.00		1.00	1.00
Fair			2.89 (1.64, 5.10)		2.85 (1.61, 5.03)	2.56 (1.41, 4.64)
Good			3.76 (2.14, 6.62)		3.74 (2.13, 6.59)	3.19 (1.73, 5.88)

Covariates: sex, age, educational level, BMI, smoking habits, alcohol drinking habits, type of medication, comorbidities, complications, and HbA_{1c} level Dependent variable: DQOL (poor, fair, and good)

Table 3 Odds ratios (95% CI) obtained from multivariable adjusted ordinal logistic models regressing QOL against sleep duration and sleep quality (model 7) and accounting for their interaction

Sleep quality Sleep duration			
	≤ 6 h	7–8 h	≥ 9 h
Poor	0.73 (0.28, 1.90)	1.00	0.16 (0.01, 1.71)
Fair	1.99 (0.72, 5.56)	1.98 (0.77, 5.14)	4.67 (1.32, 16.48)
Good	1.84 (0.61, 5.58)	3.03 (1.20, 7.67)	3.85 (1.31, 11.28)

Covariates: diabetes duration, sex, age, educational level, BMI, smoking habits, alcohol drinking habits, type of medication, comorbidities, complications, and HbA_{1c} level Dependent variable: DQOL (poor, fair, and good)

The consistently high proportions of patients reporting poor sleep in these studies highlight the seriousness of sleep problems experienced among the population in China and that this issue remains to be solved effectively. There is evidence to show poor sleep quality are potential risk factors for insulin resistance, glucose intolerance, and metabolic syndrome [32]. Thus, it is important for primary care physicians to have a high degree of suspicion of an underlying sleep disorder in patients with diabetes.

With regard to QOL in T2DM, we observed that longer sleep duration and good sleep quality were significantly associated with an improvement in QOL. Previous studies have indicated an inverse U-shaped relationship between sleep duration and QOL in T2DM patients, which implies that QOL can be detrimentally affected by short sleep duration, as well as long sleep duration [33–36]. In our study, comparatively speaking, we did not found an inverse U-shaped association between sleep duration and QOL.

Patients with sleep duration ≥ 9 h per day also showed a higher OR of improved QOL. It can be speculated that the conflicting results obtained in the current study may be due to the failure of those studies to consider the potential confounding effects of sleep quality. Nevertheless, the conclusive nature of our evidence may be limited by the small sample size of patients with long sleep duration.

The evaluation of sleep requires full consideration of sleep quantity and sleep quality. Epidemiological and experimental studies have shown that reductions in the both the quantity and quality of sleep impair metabolic control and increase the severity of T2DM [35, 37]; this association is also supported by the current study. Without adjusting for sleep quality as a confounding factor, longer sleep duration was found to be associated with higher QOL. After controlling for sleep quality, sleep duration was not significantly associated with DSQL, a finding that is consistent with those of two other studies in China [38, 39].

To preclude the interactively confounding effects, we further explored the associations of the combination of sleep duration and sleep quality in relation to QOL in T2DM patients. The results suggested that the association of sleep duration with QOL in T2DM patients varied with sleep quality. For patients with poor sleep quality, no category of sleep duration was found to be related to QOL. However, each category of sleep duration showed significant associations with QOL among the patients reporting fair and good sleep quality. Longer sleep duration had higher ORs of better QOL for patients who reported fair and good sleep quality, while an inverse U-shaped trend was observed for patients who reported poor sleep quality, although this effect was not statistically significant. Compared with other studies, our results showed that excessive

sleep duration was detrimental to QOL in T2DM patients only when they reported poor sleep quality. The combined effect of sleep duration and sleep quality suggests the importance of ensuring good sleep quality as well as adequate sleep duration. The conflicting evidence for the correlation of sleep duration and QOL in T2DM patients may be due to the failure of some studies to take the effect of sleep quality into consideration [33, 34, 40].

Patients with longer duration of diabetes have a higher rate of poor glycemic control because the function of insulin secretion has been uncontrolled over a longer period time [41]. In the current study, we also identified a relationship between diabetes duration and sleep. Considering the more frequent sleep problems and poor QOL in patients with longer diabetes duration, we have made particular efforts to control for the confounding effect of diabetes duration in the present study.

As far as we know, this is the first representative population-based study to assess the combined effects of sleep duration and sleep quality on QOL in T2DM patients in China. Nevertheless, some limitations should also be acknowledged. First, the cross-sectional survey study design limits our ability to draw causal inferences. Second, the data for sleep quality were obtained self-reported by the patients rather than the validated instrument Pittsburgh Sleep Quality Index (PSQI) in other studies. This was determined by more than one-third of participants reported none/primary educated and more than 70% of participants are elderly in our study. After a pilot study, we found that these patients were hard to understand or complete PSQI in a face-to-face interview setting. So, in view of the testability of PSQI, we determined to use simple questions considering trade-off between validity and academic authority. Moreover, many studies have confirmed the acceptable of self-reported sleep quality [30, 42–45]. Nevertheless, future studies using the PSQI are still warranted. Third, we were unable to include some well-known significant risk factors of diabetes management, such as obstructive sleep apnoea (OSA) and depression, in our study.

In conclusion, in this sample of Chinese adults with T2DM, sleep quality as well as sleep duration were found to be positively correlated with a higher QOL. More importantly, there are sleep quality-specific disparities in the association between sleep duration and QOL in T2DM patients. Failure to take into account the effect of sleep quality when evaluating the impact of sleep on QOL may be detrimental to the QOL of T2DM patients. Therefore, measures need to be taken to target specific aspects of sleep to improve the QOL of T2DM patients in China. In addition, it is important to integrate duration and quality of sleep as a composite sleep index when assessing sleep of patients with T2DM.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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Lampiran 11

Lembar Konsul



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LEMBAR KONSULTASI PEMBIMBINGAN PROPOSAL DAN SKRIPSI PROGRAM STUDI ILMU KEPERAWATAN STIKES dr. SOEBANDI

Judul Skripsi : Analisa Hubungan Kualitas Tidur dengan Kualitas Hidup pada Diabetes Mellitus
Pembimbing I : DRS. HENDRO PRASETYO, S. Kep., Ns., M.Kes
Pembimbing II : GURUH WIRASAKTI, S.Kep., Ns., M.Kep

Pembimbing I				Pembimbing II			
No.	Tanggal	Materi yang dikonsulkan dan masukan pembimbing	TTD DPU	No.	Tanggal	Materi yang dikonsulkan dan masukan pembimbing	TTD DPA
1.	16 Oktober 2020	Konsul terkait pengajuan judul dan jurnal		1.	19 Oktober 2020	Konsul terkait pengajuan judul dan jurnal	
2.	17 Oktober 2020	ACC judul		2.	19 Oktober 2020	ACC judul	
3.	14 Desember 2020	Revisi judul dan jurnal Disetujui dan segera dikerjakan ..		3.	22 Oktober 2020	Konsul revisi jurnal	

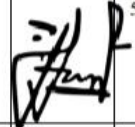
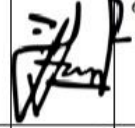
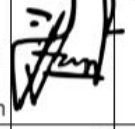


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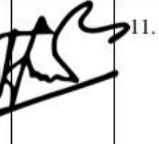
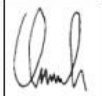
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4.	16 Desember 2020	ACC judul revisi		4.	6 November 2020	Konsul perbaikan jurnal	
5.	16 Desember 2020	Konsul bab 1 Bab 1 Revisi sesuai saran		5.	9 November 2020	Konsul perbaikan jurnal	
6.	21 Desember 2020	Revisi bab 1 291220. Bab '1. Revisi sesuai saran		6.	16 Desember 2020	Konsul bab 2 dan bab 3	
7.	30 Desember 2020	Revisi bab 1 Revisi bab 1 sesuai saran . Stlh direvisi i bs dilanjutkan Bab 2 dan 3. Hrs konsul ke pembimbing 2. anda msh blm konsul ke pemb 2		7.	26 Desember 2020	Revisi bab 2 dan bab 3, Konsul bab 1	
8.	4 Januari 2021	Revisi bab 1, Konsul bab 2 dan bab 3 Revisi sesuai saran yg ada di bab 1, 2, 3 ada komentar saya tulisan merah		8.	12 Januari 2021	Revisi bab 1	



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9.	25 April 2021	Konsul revisi proposal penelitian sesudah seminar proposal (bab 1, bab 2 dan bab 3)		9.	3 Mei 2021	Konsul revisi proposal penelitian sesudah seminar proposal (bab 1, bab 2 dan bab 3)	
10.	31 Mei 2021	Konsul bab 4 dan bab 5		10.	31 Mei 2021	Konsul bab 4 dan bab 5	
11.	8 Juni 2021	Konsul bab 6 SIAPKAN MAJU UJIAN		11.	21 Juni 2021	Konsul revisi bab 4 dan bab 5	
12.	11 Juni 2021	Melengkapi persyaratan ujian seminar hasil		12.	25 Juni 2021	Konsul revisi bab 4,5 dan konsul bab 6	



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13.	13 Agustus 2021	Konsul revisi skripsi setelah ujian seminar hasil		13.	3 Juli 2021	ACC skripsi	
				14.	31 Juli 2021	Konsul revisi skripsi sesudah ujian seminar hasil	
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				16.	10 Agustus 2021	ACC skripsi	

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